Metals Review

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W. V. Ward,
General Chairman
Western Metal Show
Technical Sessions
(See Article, Page 4)

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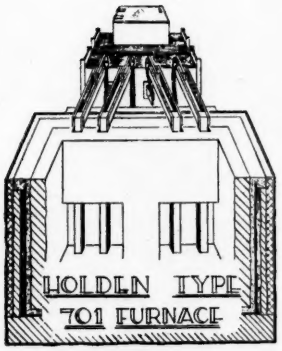

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Ward Heads Up Western Show Technical Sessions

To a young man on the West Coast go the thanks and appreciation of all the participants in the technical sessions held during the recent Western Metal Congress in Los Angeles for a job "well done". William V. Ward, metallurgical research, Lockheed Aircraft Corp., and general chairman of the technical sessions, has helped to achieve a new record of excellence in organization and presentation of technical programs. And, although he claims that any credit for the success of the Congress rightfully belongs to the panel chairmen and their speakers, he was the prime mover in getting these folks together to do the job they had to do.

Bill Ward, a native of Canyon City, Tex., was raised principally in the small copper mining town of Bisbee, Ariz. He entered the University of Arizona in 1939, enrolled in the College of Mines, where his principal interest at that time was in the study of mineral beneficiation and extractive metallurgy.

He entered the U.S. Air Force in 1942 as a private and was commissioned in 1944. He served as a navigator with a B-17 group, flying combat missions out of England in 1944 and 1945, until a well-aimed German flack burst put a serious crimp in his military career.

In 1946 Bill returned to the University of Arizona, graduating with a B.S. in metallurgical engineering in January 1947. He became interested in physical metallurgy and joined the Arizona faculty as an instructor after graduation. In 1949 he enrolled in the graduate school at Massachusetts Institute of Technology to continue studying metallurgy, and at the same time he joined the staff of M.I.T.'s mineral engineering laboratory, operated for the Atomic Energy Commission at Watertown Arsenal, as a part-time research metallurgist.

After he received his M.S. in metallurgy from M.I.T., Bill went to work for Lockheed where he is currently doing work as a research engineer.

A member of A.S.M. since 1951, Bill has served for the past two years on the executive committee of the Los Angeles Chapter, and he has been nominated for the office of treasurer for the coming season.

He married Shirley Stansbury in 1944 and is the proud father of two overactive boys, Robin, age 9, and Frederic, age 6. Reading, photography, woodworking and A.S.M. are his chief hobbies.

Registrations for Second World Metallurgical Congress Indicate World-Wide Interest

Over 555 overseas metallurgists have indicated an interest in the Second World Metallurgical Congress by requesting applications or information.

At this writing, 210 completed registrations from metallurgists all over the free world who wish to participate in the Congress have been processed. The 2nd W.M.C. will be held from Nov. 2-8 in Chicago, concurrent with the National Metal Exposition and Congress and the Second International Conference on Nondestructive Testing. The study tours which precede the Congress will begin in New York on Oct. 20 and end in Chicago on Nov. 2.

In the nine study groups available to the tour members, primary interest has been shown in Nonferrous Refining and Fabrication, with 102 requests for information, and a total of 72 requests in Steelmaking and Refining, 68 in Education and Research, and 65 in Metallurgical Aspects of Atomic Energy being submitted. Additional interest fields available to the participants of the study tours include Metal Fabrication, Heat Treatment, Welding and Joining, Inspection and Testing, and Management Problems in the Metals Industry.

Greatest representation among countries of the applicants are Great Britain (96), Germany (87), Japan (62), France (44), Sweden (31) and Belgium (30).

Description of plant and laboratory visits on each of the nine study tours, tour fees, application blanks and other information about the Second World Metallurgical Congress are available at A.S.M. Headquarters, 7301 Euclid Ave., Cleveland 3, Ohio.

Outlines Naval Research Projects at Pittsburgh

Speaker: Rawson Bennett
Office of Naval Research

The **Pittsburgh Chapter's** annual Young Fellows Night was highlighted by a talk on "Naval Research Projects" by Rawson Bennett, director, Office of Naval Research.

Admiral Bennett gave a brief background of the origins and founding of the Office of Naval Research. He described, in general, the wide scope of activities with which the O.N.R. is concerned—from human studies (psychology, etc.), through the gamut of engineering and science problems, and he mentioned the way in which the programs supported by O.N.R. are selected. Almost all of these problems originate with some researcher who presents the problem to O.N.R. for consideration. About one-fifth of these problems are deemed acceptable to and receive some backing from O.N.R. Contracts have been let to universities, commercial and industrial laboratories and nonprofit research organizations.

A large portion of the talk was devoted to the space satellite, which is near the completion of the development stage now. This is essentially a project of the International Geophysical Year, in conjunction with the Office of Naval Research.

The satellite will be 22 in. in diameter, a polished magnesium alloy globe, or gold plated, for aiding in visual pickup. About one-half of the interior is taken up by gyroscopic control instruments. About a quarter is taken up with radio devices for tracking purposes and the measurement of cosmic, ultraviolet, X-rays, etc. The other quarter is usable for space experiments. The firing of these satellites (there will be several) will not be publicized in advance. Their orbits will be elliptical and tracking stations will be distributed along a meridian, roughly down through United States and down the west coast of South America. A question was brought up as to the likelihood of Russia placing a satellite in orbit. Adm. Bennett answered that this is very likely to occur at about the same time or shortly after the I.G.Y. satellite is in orbit. Due to the Russian land mass and assumed location of spotting stations, the orbit of a Russian satellite will probably be transpolar.

The rockets to propel the satellite into outer space and place it in orbit are to be of existing types. No special work was done nor time consumed developing superfuels for rockets for this project. The propelling rockets will be in three stages. Stage one, a modified Viking, will carry the second and third stages of the satellite high into the stratosphere, approximately 170 miles; stage two, which contains the guidance control system for the rockets, will then carry the units toward outer space. Between the final blast and the second stage, and the firing of the third stage, a period of coasting will take place. This will place the satellite about 300 miles above the earth. Stage three will then fire and with motor elements in a twist to give a rifling effect, accelerate the satellite to about 18,000 mph. The third stage will then drop off and the satellite will be in orbit. There will be a fluctuation of altitude of about 200 miles, or from 200 to 400 miles above the earth. There is some question about space dust errosion factors which should be answered by the performance of the first satellite.

Data and findings of the first space exploration via satellite will be available in six months to one year after the first successful firing.—**Reported by G. F. Alcorn for Pittsburgh.**

Dayton Is Briefed on the Machinability of Steels

Speaker: W. H. Kemper
Carpenter Steel Co.

Members of the **Dayton Chapter** heard a discussion on the "Machinability of Stainless Steels" by William H. Kemper of Carpenter Steel Co., at a recent meeting.

Mr. Kemper described some of the early experimental work in improving machinability in which he took an active part. The preparation of these alloys containing vital additions was, of course, a hand operation in the early days, when cutting of a stainless steel was very difficult. This emphasized to the present-day metallurgist that what we take for granted was a long time in the development stage.

Mr. Kemper explained the use of chip curlers and breakers on cutting tools, also the necessity of close scrutiny of tool clearances and rake angles. In some cases, he pointed out, negative rake actually improved turning operations.

In the discussion period which followed the talk the speaker described many of the field problems he has helped to solve.

A coffee and doughnut session rounded out a well-balanced evening during which Mr. Kemper continued his discussion on an individual basis with some of the men who had problems they wanted to talk over with him.—**Reported by R. A. Grayson for Dayton Chapter.**

Describes Seaway Progress at Rochester

Shown in a Corridor Conference at a Meeting Held Recently by the Rochester Chapter Are, Foreground, Roger W. Allen, University of Rochester, and Left, L. M. Hale, St. Lawrence Seaway Development Corp., Guest Speaker

Speaker: L. M. Hale
St. Lawrence Seaway Development Corp.

L. M. Hale, resident engineer, Massena field office, St. Lawrence Seaway Development Corp., addressed the **Rochester Chapter** recently on "The St. Lawrence Seaway".

According to Mr. Hale, the plans for the seaway were formed in 1941, but approval was not obtained until 1954. The improved navigation facilities should prove to be a great economic aid to both the United States and Canada. In spite of the present limited 14-ft. draft, 12 million tons of merchandise was carried over the St. Lawrence last year.

Foreign trade shipping increased from one ship in 1933 to 320 ships, representing 100 shipping lines, in 1956. It is anticipated that the shipping in 1964 will amount to 50 million tons. When the navigation facilities are finished, vessels of 25-ft. draft will be accommodated.

The power facilities being constructed by both New York State and Ontario, Canada, will produce 12½ billion kilowatts per hr. The cost of the power facilities is divided equally by both countries and in this country is being financed by the sale of bonds. The navigation facilities are to be self-liquidating through toll charges.

Mr. Hale supplemented his talk by a sound motion picture and colored slides. These illustrated the depths of some of the excavations and some of the extreme working conditions encountered. About half of the concrete for the American locks has been placed. Since the Project was on schedule in December, concrete was not placed during the winter.

Interesting incidences that have arisen during the construction were described, particularly those involving cooperation between unions, contracting firms, government agencies and the two different countries. One problem that still remains is that of providing transportation facilities across the river for four months between the time that the old international bridge is closed and the new bridge opened for traffic. Mr. Hale mentioned that many of the facilities and actual work can be viewed by the public and visitors are invited to observe the progress.—**Reported by R. E. Avery for Rochester.**

Presents History of Stainless Family

Kenneth A. Matticks, Stainless Contact Metallurgist, Crucible Steel Co. of America, Presented a Talk Entitled "The Family of Stainless Steels" at a Meeting Held by the New Haven Chapter. His talk covered the three metallurgical groups and attempted to clarify certain misconceptions about their use. Mr. Matticks is shown above, left, discussing problems that were brought up by New Haven members. (Reported by James L. Baker)

Feature Aluminum at Columbia Basin

M. C. Fetzer (Right), Head of the Physical Metallurgy Branch, Kaiser Aluminum & Chemical Corp., Presented a Talk Entitled "Heat Treatable Aluminum Alloys and the Most Recent Aluminum Alloys" at a Meeting Held by Columbia Basin Chapter. Shown with Dr. Fetzer are J. A. Ayres, far left, and J. H. Rector. (Reported by R. S. Kemper for Columbia Basin Chapter)

Speaker: M. C. Fetzer

Kaiser Aluminum and Chemical Corp.

At a recent meeting of the **Columbia Basin Chapter,** a talk entitled "Heat Treatable Aluminum Alloys and the Most Recent Aluminum Alloys" was presented by M. C. Fetzer, head, physical metallurgy branch, department of metallurgical research, Kaiser Aluminum and Chemical Corp.

Dr. Fetzer classified the precipitation hardenable alloys into the Al-Cu-Mg, Al-Mg-Si and Al-Zn-Mg groups. These alloys derive their superior strengths from precipitation of $CuAl_2$, Mg_2Si and $Al_2Mg_3Zn_3$ or $MgZn_2$, respectively, through heat treatment.

Two of the newer alloys, X7079 and X7178, are modifications of the 7075 alloy. Both 7075 and X7178 alloys lie near the maximum of the iso-tensile lines when plotted on a ternary diagram of aluminum, zinc and magnesium. Part of the strength of the new alloys is due to the additions of 0.6 to 2.0% copper which raises the tensile strength 8000 to 10,000 psi. Years are required for these alloys to age harden naturally so they are ordinarily supplied in the —T6 or artificially aged condition. An increase in tensile strength of 5000 psi. can be obtained by waiting at least five days after solution treatment before aging. The X7079 alloy hardens in greater sections than the older 7075 alloy. Stress corrosion problems become more severe with the increasing zinc and magnesium contents.—**Reported by R. S. Kemper for Columbia Basin.**

Reviews Problems in the Development of Atomic Power at Montreal Meeting

Speaker: M. J. Lavigne

Canadian Westinghouse Co. Ltd.

M. J. Lavigne, head, metallurgical section, engineering department of the Atomic Energy Division, Canadian Westinghouse Co. Ltd., spoke on "Metallurgical Problems in the Development of Atomic Power" at a meeting held by the **Montreal Chapter.**

Dr. Lavigne outlined some of the basic nuclear reactor concepts, and described the metallurgical problems associated with the development of a heterogeneous, heavy-water moderated and cooled reactor, using natural uranium, for the production of atomic power. To produce power on an economical basis, it is necessary that the fuel element be stable insofar as possible during its operation in the reactor. The speaker went on to explain that uranium alloys with good corrosion resistance have been developed, and that the compound, uranium dioxide, because of its high melting point, 2800° C., and its structural stability in inert atmosphere, offers some solution to the fuel problem. However, the compound also presents some metallurgical problems. It has a low thermal conductivity and poor thermal shock resistance. Furthermore, its fabrication into fuel elements is expensive.

For thermal neutron reactors, fuel sheathing or canning materials are very few, namely, magnesium, beryllium, aluminum, zirconium and some of their alloys. Magnesium has poor corrosion resistance in water, and beryllium presents many fabrication difficulties, due to its structural characteristics and its toxicity.

Dr. Lavigne brought out the point that much progress has been accomplished in the last three years to solve some of the metallurgical problems encountered in the development of a natural uranium reactor designed for the production of atomic power. However, much work has yet to be done to produce a low-cost fuel material and to develop adequate and cheaper reactor construction materials which will definitely lead to the production of economical atomic power.—**Reported by G. F. Norman for Montreal.**

Cold Extrusion of Steel Subject in Pennsylvania

Speaker: John E. King

Heintz Manufacturing Co.

John E. King, Heintz Manufacturing Co., addressed a recent meeting of the **Northeast Pennsylvania Chapter** on the subject "Cold Extrusion of Steel".

The cold extrusion of steel was originated in Germany in the early 1930's as a consequence of economic and raw material limitations on the metals industry. Shortly after World War II the process was introduced in this country. Mr. King discussed the development of cold extrusion since that time and presented numerous examples of current applications of the process.

Two basic extrusion operations, forward and backward extrusion, are the essential operations employed in this practice. The major advantage of cold extrusion is the appreciable cost savings which are brought about by several features of the process. A relatively high degree of surface finish and closer tolerances than can be attained by other forming techniques result in fewer machining and finishing operations. This means additional material savings and reductions in labor costs. Furthermore, the cold working of low carbon steels develops material properties which makes it possible, in some instances, to replace higher alloy steels with cold extruded parts, thus eliminating the final heat treatment.

Mr. King described the fabrication by cold extrusion of a number of different parts now in production. The manufacture of rocket heads and artillery shells has yielded up to 40% material savings over conventional fabricating methods. Similar savings are evident in commercial applications, especially in the automotive field where the use of cold extrusion of steel is expanding rapidly. A color movie showing the cold extrusion of rocket heads was also shown.—**Reported by J. Jacobs for Northeast Pennsylvania.**

Panel on Metal Cleaning Presented at Hartford

A panel discussion on "Metal Cleaning" was featured at a recent meeting of the **Hartford Chapter.** Members of the panel, each of whom gave a short talk on his subject before the meeting was opened for questions and discussion were: John A. Swift, president, Swift Industrial Chemical Co., moderator; T. R. Hendrixson, service manager, Chlorine Products Division, E. I. duPont de Nemours & Co., on "Chemical Cleaning"; A. R. Burman, vice-president, Cro-Plate Co., on "Mechanical Cleaning"; Eugene Fioramonti, representative, Scientific Products Division, Curtiss Wright Corp., on "Ultrasonic Uses"; and Leonard Giglio, foreman, Hartford Machine Screw Co., on "Consumer Problems".

Mr. Hendrixson split chemical cleaning into three groups: alkali, which is the most widely used and the most versatile; emulsion, which is really more physical and is used mainly to remove solids; and vapor degreasing, which is fast, leaves work dry and is readily interpreted with other shop processes. He showed slides which compared cost of alkali cleaning versus vapor degreasing of various products, and slides showing examples of vapor degreasing equipment and installations.

Mr. Burman spoke on the blast phase of mechanical cleaning which he divided into two groups: dry, which usually uses sand and is relatively coarse; and wet, which is sometimes called vapor and uses a fine abrasive. The abrasives are driven by either compressed air or from a tangential wheel. Either method produces a matte finish. The main purpose of the liquid in the wet method is to give the fine abrasive enough mass to drive it against the work. In some cases organic material, such as ground nut shells, is used for the wet abrasive. The volume of work and finish desired (abrasive size) determine the type of equipment to be used, wet or dry, manual or automatic.

Mr. Fioramonti stated that ultrasonic cleaning is really abrasion by sound waves using a chemical medium. Normal procedure is to immerse a transducer operating at about 40 kilocycles into the solution. The following are advantages of ultrasonic cleaning:

1. It is useful on delicate parts, such as instruments, and will clean whole assemblies, including remote areas, without disassembly.
2. Equipment and operating costs are reasonable.
3. It will remove unlimited contaminants, including such items as buffing compounds which were formerly hand wiped.
4. Lower cost solutions, such as alkali substituting for solvent, can be used.
5. Materials handling is the same as with other processes.
6. It produces very high quality, chemically clean work.

Ultrasonic cleaning can be applied to primary manufacture of material and parts, to service work such as instruments and clocks, and to major overhaul and repairs.

Mr. Giglio covered consumer problems, such as rust or scale on bar stock, sand in castings, and lubricant on wire for cold heading machines. Other problems in process cleaning mentioned included cutting fluids, chips and grinding dust, and heat treating salts and soot.

A lively question period followed with Jack Swift as moderator.—**Reported by B. L. Taft for Hartford.**

Discusses Design of Steel Castings

"Design Factors in High-Strength Steel Castings" Was the Topic Presented by C. W. Briggs, Steel Founders' Society, at a Meeting of the Long Island Chapter. Shown are, from left: J. A. Scheick, technical chairman; Mr. Briggs; Charles Sammis, chairman of program committee; and W. W. Rogers, chairman. A highlight of the meeting was the presentation of certificates to men who successfully completed the Educational Series on Welding Metallurgy, given by L. Anselmini of the Republic Aviation Corp.

Brings Aluminum Alloy Up To Date at Long Island

Speaker: G. MacDonald Young

Aluminum Co. of Canada

"Aluminum Alloys Up to Date" was the subject discussed by G. MacDonald Young, technical director of the Aluminum Co. of Canada, and vice-president A.S.M., at a recent meeting of the **Long Island Chapter.**

An historical outline of the development of aluminum and its alloys dating back to 1825 was presented. In the period preceding the electrolytic process, developed in 1886, aluminum was alloyed with copper, silicon and other metals. A rolling process was developed for cladding aluminum on copper or brass 74 years before the first commercial aluminum alloy clad product was offered to the public. With the advent of the electrolytic process for reducing alumina, the price was greatly reduced, encouraging wider application. New alloys were developed for casting, wrought production and extrusion. The contributions of Britain, Germany, Switzerland and Japan were discussed.

Characteristics of the alloys, such as mechanical strength, hot working properties, fluidity and hot shortness were correlated with various alloy additions. During the years, properties of aluminum alloys have been continuously improved. Examples were given of the development of "double-hardening" type alloys containing magnesium silicide and of an aluminum-silicon casting alloy employing sodium additions to control the mode of silicon crystallization. Mr. Young also pointed out that still further information should be forthcoming concerning the effects of trace elements on the properties of aluminum alloys; these elements, while they may be undesirable in uncontrolled amounts, may impart desirable properties in certain controlled concentrations.

A twenty-five year membership certificate was presented to Hans J. Rose of the Fairchild Engine Division during the meeting.—**Reported by J. Fugardi for Long Island.**

Jacksonville Features Three Speakers

From Left: R. J. Painter, Executive Secretary and Treasurer A.S.T.M., A. O. Schaefer, Past President A.S.M. and President, Pencoyd Steel and Forging Co., Rudolph Schatzel, Vice-President, Rome Cable Corp., and President A.S.T.M., William Tiffon, University of Florida, and Paul Lindh, Dean, Jacksonville University, at a Joint Meeting Held by the Technical Societies of Jacksonville. Dr. Schatzel presented a talk on "Wire and Cable", Mr. Schaefer presented a discussion on "Brittle Failure of Metals", and Mr. Painter gave a talk on "Standards for Materials"

Speakers: Rudolph Schatzel
A. O. Schaefer, R. J. Painter

Illustrated talks on the fascinating stories of "Insulated Wire and Cable", the "Brittle Failure of Metals", and "Standards for Materials" were presented before a joint meeting of Jacksonville technical and professional societies, sponsored by the **Jacksonville Chapter A.S.M.** The meeting featured R. A. Schatzel, president of the American Society for Testing Materials and vice-president and director of engineering, Rome Cable Corp., A. O. Schaefer, past president A.S.M. and president, Pencoyd Steel & Forging Co., and Robert J. Painter, executive secretary A.S.T.M.

A special get-acquainted dinner to which the officers of Jacksonville's various technical societies were invited was sponsored by the American Society of Testing Materials in an attempt to bring about even closer relationship between engineering and research people in this area.

Robert J. Painter, who spoke on "Standards for Materials", based his topic on the theme that research and standardization go hand-in-hand. According to Mr. Painter, the greatest invention in our times is the invention of teamwork. To develop standards he pointed out one must know the facts—this involves research—and one must get the cooperation of the user and the manufacturer. A standard was defined as a criterion reached through common consent, really a compromise. It involves strict definition of terms, standards for testing and standards for doing the research work.

Dr. Schatzel spoke on the fascinating story of "Insulated Wire and Cable". He indicated that no useful application of electricity is made today without wire or cable. He pointed out that the history of electrical progress in this country stems from 1882 when Thomas Edison was responsible for the Pearl St. station in New York. Ever since then kilowatt sales have doubled in each ten year period. So far, in the past eight year period, they have already doubled. Limiting factor in pushing power through insulated cable is the materials they have available. Currently Scandinavian countries have been able to push power at 380,000 volts through insulated cable. Although we are currently doing research work in this country to reach 400,000 volts, we are far below the 380,000 in actual practice. Dr. Schatzel defined wire as containing three basic parts: a conductor, which is metallic; insulation, which is either organic or inorganic; and a sheath, which is composed of either lead, plastics or rubbers. Some of the newer insulation material provide their own sheaths. Aside from the generation of power, the three major aspects are: transmission at high voltage; distribution at low and moderate voltage; and final utilization at low voltage. The key to power is reliability and the high factor of safety required. Conductors are made of copper, aluminum, copper-clad steel, copper alloys and nickel and iron alloys. Sheaths are metallic, treated fiber, or extruded nonmetallics. When aluminum is used in place of copper the size of the conductor must be increased, and, although the weight is less, strength is appreciably lower. The use of aluminum cuts the cost 34% over copper, but increases the size approximately 160%. Some of the most common insulating materials which are being used are paper, rubber, plastics, fibers, yarns (textiles) and varnished materials.

Mr. Schaefer spoke on "Brittle Failure of Metals". He discussed primarily the failures in large forgings used at public power stations. These failures concern the nickel-molybdenum rotor steels. He explained how the cause was tracked down and how, through standardization and testing we hope to eliminate it. Special techniques for measuring hydrogen content have been developed. Ultrasonic inspection techniques were discussed, and Mr. Schaefer pointed out the need for evaluating test results. He described a program at General Electric which has just resulted in a new standard for evaluating ultrasonic inspection results. This test was based on the use of more than 1500 forgings, and is now being voted upon as an A.S.T.M. standard. Appraising the susceptibility of a piece of metal to brittle fracture is a very difficult thing, and a variety of tests have been worked on. It has been noticed that if the material is all martensite there is very little danger of brittle fracture; therefore, the search has been on to find methods of simply detecting whether or not the material is all martensite. Best results seem to be obtained from the Charpy notch test, and this test is therefore being recommended for appraising the susceptibility of a piece of metal to brittle fracture.

Jacksonville Members Hear Tubing Specialist

Speaker: John F. Beck
Babcock & Wilcox Co.

John F. Beck, supervisor of technical services, Tubular Products Division, Babcock & Wilcox Co., spoke on "Specifying Pipe and Tubing" at a recent meeting of the **Jacksonville Chapter.** Mr. Beck, a graduate of Pennsylvania State University, has spent the last seven years in high-temperature alloy pressure pipe and tubing research.

The meeting was held at Southside Generating Station in Jacksonville, and the technical presentation covered the function of pipe and tubing in generating and transmitting steam, metallurgical problems in connection with such service, specifications, standards, ultra pressure tube, universal pressure boiler and tubing for the atomic age.

A plant tour preceded the technical session.—**Reported by George Black for Jacksonville.**

Speaks on Steels for High-Temperature Bearing Service at Cincinnati

Speaker: E. S. Rowland
Timken Roller Bearing Co.

Members of the Cincinnati Chapter were addressed by E. S. Rowland, chief metallurgical engineer, Steel and Tube Division, The Timken Roller Bearing Co., on the subject, "High-Temperature Bearing Steels".

Dr. Rowland stated that the advent of the jet aircraft brought with it many high-temperature bearing problems since, at temperatures in excess of 300° F., ordinary lubricants are unsatisfactory, dimensional changes occur in steels and they tend to lose hardness. High speed steels in these applications have left something to be desired.

Some of the requirements often demanded by design engineers for high-temperature bearings are listed below.

1. Hot hardness of RC-58 at temperatures from 400 to 1500° F.
2. Dimensional stability at these temperatures.
3. Non-seizing qualities.
4. Corrosion resistance to air or lubricant.
5. Load carrying capacities at elevated temperatures similar to that of 52100 or carburized steel at room temperature.
6. Material that is easily ground and heat treated.

Dr. Rowland stated that from fatigue tests made with various lubricants at elevated temperatures a few general observations could be made. He indicated that at higher viscosities higher loads were permissible. While the speaker declined to directly place the high-temperature shortcomings on the lubricants he did indicate that the lubricating problem is much in evidence. He further indicated that at the higher temperatures there is indication of chemical reaction at the lubricant-steel interface.

Petroleum lubricants perform more satisfactorily than hydraulic fluids and although silicones are good to 500° F., they give poor lubricating qualities.

The effect of the internal quality of the steel as measured by Magnaflux indications versus test life in bearings indicated that the minimum test life is not affected, although the maximum life is shortened with increase in the number of indications. Further investigation of the effect of internal quality was conducted with seven vacuum melted heats, producing mixed results. In tests made on five of these heats there was no improvement in minimum or median bearing life as compared with material produced by conventional melting practice, while in two heats minimum life and median life was at least doubled. While the nonmetallics were lower in all heats, the good heats could not be metallurgically resolved from the poorer ones.

The effect of alloying elements on high carbon-chromium steels for service up to 600° F. was studied by measuring hot hardness and recovered hardness. Manganese additions showed little change in properties while chromium showed only slight increase in resistance to hardness above 800° F. Molybdenum showed an increase in hot hardness, but additions greater than 0.50 showed only slight increases. Aluminum and silicon had the greatest influence on resistance to tempering of all the alloying elements studied.

In closing, Dr. Rowland indicated that while the problem of high-temperature bearing service is a real one, he feels that designer's demands of hot hardness equivalent to room temperature hardness for bearing service are not realistic, especially since lubricants present at least an equal problem based on our present knowledge.

—Reported by John H. Timmers for Cincinnati Chapter.

Discusses Hydrogen Embrittlement

Herbert H. Johnson, Case Instiute of Technology, Presented a Talk Entitled "Practical Aspects of Hydrogen Embrittlement" at a Meeting Held by Indianapolis Chapter Recently. Shown at speaker's table are, from left: G. J. Shubat, vice-chairman; Mr. Johnson; and E. Tuttle, chairman

Speaker: H. H. Johnson
Case Institute of Technology

At the Indianapolis Chapter's Sustaining Members night meeting, Herbert H. Johnson, Case Institute of Technology, spoke on the "Practical Aspects of Hydrogen Embrittlement".

The speaker illustrated the problem of delayed failure due to hydrogen embrittlement by citing examples of aircraft failures.

He pointed out that hydrogen enters steel in the atomic form from acid pickling baths and electroplating processes, particularly cadmium.

The tests for Mr. Johnson's experiments were made on 4340 material with a tensile strength of 230,000 psi. The specimens were electrolytically hydrogenated, cadmium plated, and then baked at 300° F. for varying amounts of time.

Most of the testing was done with notched tensile specimens in stress rupture tests wherein a fixed load was applied over a given period of time. The static load test is most sensitive for finding the presence of hydrogen. Hence, the tensile test, which breaks the specimen in a minute or less, and the bend test may not detect the presence of hydrogen.

Tests were also made which showed that the severity of the stress state is a factor in failure. Experimentation showed that there is a fixed period for crack initiation depending upon the time at baking temperature.

Important facts concerning cadmium plating and hydrogen embrittlement pointed out by the speaker were:

1. Cadmium plate is a substantial barrier to the out-gassing of hydrogen.
2. Recovery depends on plate thickness.
3. Delayed failure is most severe in presence of stress concentration.
4. Whether or not a crack initiates is dependent upon the stress state and hydrogen concentration.
5. Short-time mechanical tests may not pick up hydrogen embrittlement.

—Reported by Dorothy Holbrook for Indianapolis Chapter.

Boston Panel Discusses Heat Treating

"Commercial Heat Treating Practice" Was the Subject Discussed by a Panel of Speakers at a Meeting Held by the Boston Chapter Recently. Shown, from left: H. I. Dixon, Metallurgical Products Co., panel moderator; Al Sherys, Porter Forge & Furnace Co.; Lloyd Field, New England Metallurgical Corp.; and Walter Ebersteen, Industrial Heat Treating Co.

The increasing importance of dependable, modern commercial heat treating facilities was recently brought out during a meeting of the **Boston Chapter** when a panel composed of Lloyd Field, vice-president, New England Metallurgical Corp., Al Sherys, vice-president, Porter Forge & Furnace Co., and Walter Ebersteen, president, Industrial Heat Treating Co., discussed "Commercial Heat Treating Practice".

The panel moderator, Harry Dixon, president of Metallurgical Products Co., stated that the 63 members of the Metal Treating Institute had reported over $200-million worth of commercial heat treating business in their plants in 1956. During the same period, furnace manufacturers produced over $188-million worth of heat treating equipment. Many companies feel that they can obtain a better job more cheaply by using commercial heat treating facilities rather than by trying to train their men to operate the equipment themselves. A good heat treater has to be familiar with many phases of treatment, relatively unknown a few years ago, and be able to handle all materials, sizes and shapes.

Mr. Ebersteen spoke of the problems of heat treating aluminum and magnesium where furnace temperatures do not go above 1200° F., but where temperature controls must be accurate to avoid distortion or possible melting. These alloys are treated to relieve cold work stresses and to improve mechanical properties. Aging treatments are carried out at room temperature, or artificially at temperatures from 250 to 600° F. Solution treatment and quenching in hot or cold water is quite common. If distortion results, straightening must be done at once. Stress relief at aging temperature may be helpful to maintain tolerances during machining. Magnesium and aluminum parts should never be treated together in the same furnace at the same time because of their different properties.

Mr. Sherys discussed the advances which have taken place in the design of modern batch-type forced-convection, atmosphere - controlled furnaces. These single vertical units have a wide range of uses—carbonitriding, carburizing, carbon restoration, hardening of tool, alloy and stainless steels, and brazing. The importance of intelligent supervision and the skill of a good operator are doubly important in this type of equipment. The heat treater must know how to regulate his atmosphere and gas flow to give desired properties to the finished parts. At the same time, he has to run the batch-type furnace, on all sizes and grades of steel, usually by using trays and alloy fixtures where oil or water quenching of parts may be involved. Cost is important, and the cost per pound of finished work is determined by how efficiently he utilizes his furnace and atmosphere.

Mr. Field listed the six commercial types of atmospheres in use today. Exothermic generators use the products of fuel gas with control of the fuel-air ratio. The gas produced varies in composition up to 18% max. hydrogen with CO up to 12%, CO_2 up to 12%, balance nitrogen, when dew point is 80° F. When dew point is −40° F., hydrogen content can be 2 to 30%. CO 0.05%, and CO_2 0.05%, balance nitrogen.

Endothermically produced gas usually contains less than 0.05% CO_2, 20% CO, 40% H_2, balance nitrogen. The dew point may vary between 0 and 30° F., depending on equipment. A small amount of methane may also be present, usually under 1%. Low carbon dioxide and water vapor content, as well as methane, are important. Carbon monoxide is really the "workhorse"; by varying its content, carbon restoration to decarburized steel is possible, as well as direct carburization of low-carbon steel.

Dissociated ammonia, produced in a reaction retort containing a catalyst inside a heating chamber, produces relatively low-cost, high-purity hydrogen gas with low dew point. Argon, helium and lithium are other gases which have been used for atmosphere work, but they are expensive and are not in common use.—**Reported by H. I. Dixon for Boston.**

Syracuse Holds Howard Stagg Night

Shown at a Meeting Held by the Syracuse Chapter Designated as Howard J. Stagg Night Are, From Left: Mr. Stagg, One of the Originators of the Chapter and Its First Chairman; and Benjamin Franklin Shepherd

Outlines Developments In New Materials and Processes at Columbus

Speaker: J. R. Willard
Aluminum Co. of America

The **Pittsburgh Chapter** heard J. R. Willard, manager of the development division, Aluminum Co. of America, speak on "New Developments in the Aluminum Industry".

In his preliminary remarks, Mr. Willard assured his audience that the aluminum producers have adequate facilities to supply aluminum for the new markets. When the presently announced expansion programs are completed, the primary production of aluminum will have been increased approximately 15 times over the 1939 level. When the announced expansions are completed, the production capacity will be 2,552,000 tons in the U.S.A. and 1,122,000 tons in Canada. In addition to pig-producing capacity, adequate fabrication facilities, such as rolling mills, extrusion presses, forging equipment, etc., are available.

Mr. Willard pointed out that the things he was discussing were not entirely new, but that many of them had had limited usage for a number of years. The developments which he discussed had rather recently achieved enough prominence to be considered as having been *really* developed. Often the things that appear new to the public are sometimes old to the research scientists and development engineers who have been experimenting and making field tests.

The developments which Mr. Willard described were in three classes: new alloys; new processes and mill products; and new markets.

Among the new alloys, the most impressive recent development is in the high magnesium-containing alloys, usually in combination with small amounts of manganese. Typical of this class is 5456, having a nominal composition of 5.25% Mg, 0.8% Mn, and 0.1% Cr. This alloy, which is nonheat-treatable, has a nominal tensile strength of 55,000 psi., a yield strength of 33,000 psi., and an elongation of 16% in the hot rolled or as-extruded temper. The formability is good and the resistance to corrosion is also good. Weld efficiencies of about 90% are attainable on the full section welded specimen.

Other new alloys worthy of note include the high-strength heat treatable alloys, 7178 for sheet, plate and extrusions, and 7079 for forgings. A new casting alloy, A356, and a new die-casting alloy, X364, deserve attention because they have higher ductilities than the old alloys.

Mr. Willard mentioned new processes and aluminum mill products such as roll-bonded sheet, tube-in-strip, abrasive treadplate, Boral sheet, and no-draft forgings.

New markets were illustrated by means of slides. Examples were shown of applications in agriculture, aircraft, appliances, architecture, transportation, chemical, electrical, hydraulics, marine, railroad, structural and packaging fields. Of particular interest is the architectural field which accounts for over one-fifth of the total aluminum market. This field was illustrated by a picture of the rather spectacular aluminum-clad Republic National Bank Building in Dallas. Other architectural applications were illustrated by smaller buildings, a hospital and a church.

Mr. Willard predicted that aluminum would soon be used in large quantities in residential building for side walls, piping, wiring, roofing, as well as many other places.—**Reported by J. P. Lyle for Pittsburgh Chapter.**

Texas Hears Talk on Notch Bar Tests

Samuel L. Hoyt, Consulting Metallurgist, Presented a Talk Entitled "Interpreting Notch Bar Impact Tests" at a Meeting Held Recently by the Texas Chapter. Shown during the meeting are, from left: Robert C. Anderson, executive committee; Mr. Hoyt; and C. L. Horn, vice-chairman

Speaker: Samuel L. Hoyt
Metallurgical Consultant

Samuel L. Hoyt, metallurgical consultant, addressed the **Texas Chapter** in Houston on the "Interpretation of Notch Bar Impact Tests".

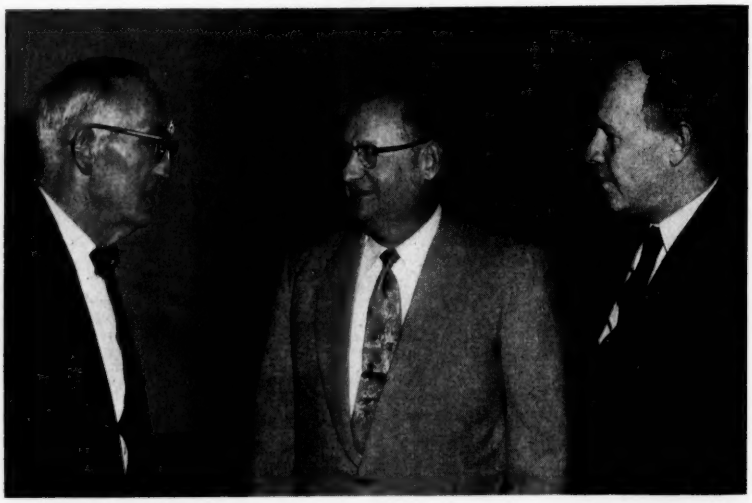
Dr. Hoyt, whose interest in notch bar studies dates back to 1912, presented a concise outline of the significance of the impact test and "transition temperature" as applied to wrought, nonheat treated steels. He reviewed the intensive work on ship plate initiated as a result of the Liberty Ship failures during World War II. This work included a very comprehensive study of steelmaking variables and their relationship to transition temperature, where transition temperature or "match point" is defined as the temperature where the fracture behavior of a series of notch bar tests of specified design becomes brittle, as displayed by the point of low level energy absorption.

Among the steelmaking variables, Dr. Hoyt discussed carbon content, manganese content, carbon-manganese ratio, level of residual deoxidizers (aluminum, silicon, titanium, vanadium), rimmed versus semikilled practices, hot mill finishing temperatures, microstructure, and orientation of microconstituents.

Emphasis was placed on the important practical consideration of simulating the brittle service failure by using the type of notch test bar best suited to the application or end use of the particular material being evaluated. Notch geometry must be consistent with the physical properties of the material if the test is to detect the behavior required to qualify a material to a specified end use or service requirement. Case histories were cited to illustrate this point.—**Reported by G. W. Brooks for Texas Chapter.**

A.S.M. created the Annual Teaching Award in Metallurgy, open to teachers of metallurgy in the United States and Canada. Value $2000.

Talks on Metallurgy in Atomic Energy



H. A. Wilhelm, National Trustee A.S.M., Iowa State College, Presented a Talk on "Metallurgy in Atomic Energy" at a Meeting in Boston. Shown are, from left: H. D. Stuck, chairman; Dr. Wilhelm; and R. D. Pomfret

Speaker: Harley A. Wilhelm
Iowa State College

The increasing demand for nuclear power reactors which require fuels and metals with special properties have made the scientific world more conscious of the work done by the metallurgist. The metallurgy in this field was ably pictured by National Trustee H. A. Wilhelm, before the **Boston Chapter** in a talk on "Metallurgy in Atomic Energy".

Dr. Wilhelm described the early work done on production of uranium at Westinghouse in Bloomfield, N. J., at Metal Hydrides, Inc., and at Iowa State College. Some details were presented on the preparation of the metal from uranium tetrafluoride by reduction with the calcium or magnesium process developed in 1942. More than a thousand tons of uranium metal was produced by this method at Iowa State College before the process was turned over to industrial concerns during World War II.

Dr. Wilhelm described the process of nuclear fission, whereby a neutron hits a nucleus of uranium-235, with a subsequent splitting of that nucleus into the nuclei of two smaller atoms. The energy released during the fission process provides the heat for atomic power. Both plutonium-239 and uranium-233 fission the same as U-235; these three are potential fuels for power reactors. A piece of uranium metal the size of a golf ball has more available energy that 30 carloads of coal.

Dr. Wilhelm showed how a graphite-moderated pile containing several tons of normal uranium can, under proper conditions, produce plutonium-239 from uranium-238. The speaker emphasized the importance of neutron conservation in an atomic reactor. Bearing on this conservation are the neutron-capture properties of materials used in an atomic furnace. Metals for use in reactors not only must have acceptable properties in the ordinary sense, such as high-temperature strength and corrosion resistance, but also must have acceptable nuclear properties for the particular application. The absorption values of a number of elements for both slow and fast neutrons were used to point out why specific materials are used as components in certain reactors, why other materials are essentially ruled out, and why the metallurgist is working to develop new metals and alloys to meet the demands for efficient, regenerative nuclear reactors.

Zirconium, for example, has low neutron-capture properties combined with desirable physical and corrosion properties. Stainless steel, because of its fabricability and good physical and corrosion properties, has been employed in the construction of reactors.

In an atomic power plant heat transfer fluids may convey the heat from the reactor through an exchange system to a boiler where this heat is used to generate steam. The steam can be employed in a turbine for driving a generator and thus can supply electrical energy. It is hoped that eventually we will be able to generate electricity by atomic power plants at costs of less than 6 mils per kilowatt-hour; present costs are much higher.

Materials with ideal properties for reactor applications do not exist, so the metallurgist is working on all metals, including the less common metals, in an effort to develop better materials for reactors. An advance in nuclear metallurgy may be directly reflected in the advance toward economic nuclear power. There exists then an open challenge to the research metallurgist in the field of metallurgy in atomic energy.—**Reported by H. I. Dixon for Boston.**

Presented Scholarship in Boston

Owen F. Devereux, Student at Massachusetts Institute of Technology, Was Recently Presented With an A.S.M. Scholarship Award at a Meeting of the Boston Chapter, and Richard F. Smith, Also a Student at M.I.T., Was Presented With the Boston Chapter Scholarship. Shown at the meeting are, from left: W. A. Backhofen, M.I.T., Mr. Devereux and Mr. Smith

Covers Applications of Titanium in Philadelphia

Speaker: F. H. Vandenburgh

Mallory—Sharon Titanium Corp.

The members of the **Philadelphia Chapter** heard a talk on "Titanium, an Engineering Metal With Growth Potential" by Frank H. Vandenburgh, vice-president and general manager, Mallory-Sharon Titanium Corp.

Titanium is the fourth most abundant metallic element in the earth's crust. Its outstanding properties are its resistance to corrosion and high strength to weight ratio.

At the present time the military is using about 97% of the titanium products of the country. Its light weight makes it particularly useful to the aircraft industry. Titanium is replacing aluminum and stainless steel in aircraft where elevated temperatures are used. It is lighter than stainless steel and maintains its strength up to about 850° F.

The heat conductivity of titanium is similar to that of stainless steel. However, titanium expands and contracts to a much lesser degree than aluminum when heated and cooled.

The corrosion resistance of titanium is remarkable. In many environments it is superior to stainless steel. The U. S. Navy is particularly interested in titanium because of its resistance to corrosion by sea water. Titanium resists corrosion in marine atmospheres, sea spray and immersion in or impingment by sea water. No corrosion takes place under fouling organisms that may grow on the metal when immersed. Tests made have determined that titanium is the only high-strength structural metal known for which the stress cycle curve in the salt water corrosion fatigue test approaches closely the stress cycle curve for test in air.

A chemically stable and protective oxide film forms on the metal on exposure to air. It is not affected by body fluids and therefore has potential use by the medical profession. However, there is still a good deal of research needed in this field.

Titanium is not affected by food or food products and is nontoxic. The food processing industry will be able to make much use of this metal.

Although only a small amount of titanium is going into the chemical industry, it is the opinion of the titanium manufacturers that this industry will represent a large and permanent market for this metal. Its extraordinary resistance to corrosive effect of many chemical substances makes it especially attractive. One example is in a high-pressure leaching process using dilute sulphuric acid solution. Type-316 stainless steel lasted only 2 to 3 hr., whereas parts made of titanium are still in service after four years of continuous use.

The use of titanium is expected in the pharmaceutical field, electrochemical processes, atomic reactors, paper and pulp industry, petroleum and ore beneficiation.

Titanium is not a "wonder metal" and there is still much research to be done. At present the cost is very high, although it has been dropping and is expected to continue to do so. As the cost becomes competitive with the other metals it will take its rightful place in the metals industry.—**Reported by H. A. Foy for Philadelphia Chapter.**

Gives Controlled Atmospheres Course

The Hartford Chapter Has Recently Completed a Series of Three Lectures on "Controlled Atmospheres". Registrants numbered 136. Clyde M. Adams, Jr., Department of Metallurgy, Massachusetts Institute of Technology, the lecturer, spoke on "Principles of Gas-Metal Reactions", "Prevention or Promotion of Oxide Formation", Carburization, Decarburization, and Protective Atmospheres". Shown are, from left: Prof. Adams, and Eli F. Bradley, chairman of the Hartford educational committee

Gas Turbine Design Is Subject at Baltimore

Speaker: N. L. Mochel

Westinghouse Electric Corp.

Norman L. Mochel, Westinghouse Electric Corp., spoke on "Metallurgical Aspects of Modern Gas Turbine Design" at a meeting of the **Baltimore Chapter.**

The modern gas turbine operates at temperatures between 1300 and 1400° F. Although a gas turbine may produce 6000 h.p., 4000 h.p. is consumed by the compressor and 2000 h.p. is left for whatever use desired.

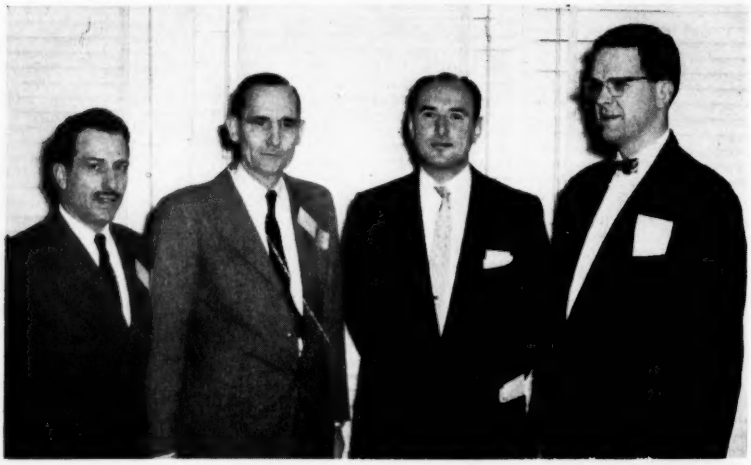
Gas turbines are frequently used to pump fuel oil and gas across country because of the simplicity of the procedure. The fuel is present in the transport pipe lines and no water is necessary; therefore, they may be used in isolated areas. Some turbines used for this purpose have had 30,000 to 40,000 service hours and are still operating.

There are five basic gas turbine designs: simple operating cycle; compound operating cycle with regenerator; compound operating cycle; compound operating cycle with intercooler regenerator; and compound operating cycle with inter-cooler. Now in service is a 5000 kw. gas turbine-generator mounted on a railroad car for maneuverability. The electrical equipment necessary for operation is mounted on an adjoining car.

The most critical part of the turbine is the rotor which was a one-piece forging in the original turbine. The one-piece forging was not considered as the proper approach because of the difficulty in obtaining sound forgings. The rotors are now built from multiple disks. The longest forged turbine blades are 10 in. long and are made from Inconel X material. The question at present is how long will they last at 1350 to 1400° F. Cast blades are also being considered because of the reduction in cost.

Welding of diaphram nozzles is a current problem in the gas turbine development, but corrosion of turbine parts is no problem because of the fuels now in use. Many test units of gas turbines are now operating to determine materials for use with high-temperature operation. Higher output is obtainable in gas turbines when gases are used at high temperature. Long and short time tests are being conducted to ascertain the materials necessary.—**Reported by G. M. Hinton for Baltimore.**

Explains Stress Corrosion at Buffalo



J. J. Harwood, Office of Naval Research, Spoke on "Stress Corrosion" at a Meeting Held by Buffalo Chapter and the Niagara Section N.A.C.E. Shown, from left: H. Caldwell, N.A.C.E. chairman; C. Bishop, N.A.C.E. program chairman; Mr. Harwood; and Matt Hayes, Buffalo Chapter chairman

Speaker: J. J. Harwood
Office of Naval Research

Stress corrosion cracking can be likened to brittle fracture and is considered a brittle fracture process by Julius J. Harwood, head of metallurgy, Office of Naval Research, Navy Department. In his discussion on "Stress Corrosion" before the **Buffalo Chapter** and the Niagara Section of the National Association of Corrosion Engineers, Mr. Harwood indicated that stress corrosion cracking is of an insidious nature since its effects can not be calculated in the same manner as one can calculate the effect of pitting corrosion. He further pointed out that stress corrosion cracking is particularly difficult to predict because in themselves the stresses and the corrosion, which are responsible in combination for the stress corrosion cracking, have little effect individually, whereas the net effect of the two acting in unison can produce cracking and ultimate structural failure. There is no deterioration of the mechanical properties of the base metal until the first crack occurs and then a marked decrease in strength and ductility properties takes place.

Mr. Harwood indicated that some very definite understandings of the stress corrosion cracking phenomena have been made. He pointed out that stress corrosion cracking never occurs in a pure metal. It always involves a "multi-element" alloy and is very definitely of the standard anodic-cathodic reaction type. Further, the stresses present must be of a tensile nature. Compression stresses do not constitute an agency for stress corrosion cracking. The tensile stresses generally appear to affect the crack propagation rate and not the rate of nucleation. Studies to date indicate that some of the definite stages in the propagation of stress corrosion cracks involve: (1) an electrochemical action on a material susceptible to corrosion, (2) the formation of a corrosion fissure or, from a stress concentration point of view, a notch, (3) plastic deformation of the material at the root of the notch, and (4) crack formation. The studies have indicated that cracking then progresses quite rapidly due to one or a combination of the following factors: mechanical cracking from the applied stress; rupturing of passive films and the exposure of fresh metal at the base of the crack; or perhaps a change in the electrochemical activity at the base of the crack due to the changes in the structure ahead of the crack; or chemical cutting which may result from the effects of adsorbed films in decreasing the energy necessary to form a new surface (i.e., crack propagation); or perhaps just plain hydrogen embrittlement and its normal effects.

But, Mr. Harwood concluded, stress corrosion cracking can be effectively combated by one of six mechanisms which are available to the designer of each and every part that might be subjected to stress corrosion. These mechanisms are: (1) the use of proper design and fabrication techniques to assure that the assembly has a minimum of residual tensile stresses; (2) stress relief of the part as a final assembly operation; (3) the use of chemistry to control the susceptibility of the base material to corrosion attack; (4) cathodic protection either by impressed currents or cathodic coating; (5) treating the part so that the surface is in compression; and (6) the introduction of inhibitors into the corroding medium.—**Reported by G. F. Kappelt for Buffalo.**

Compliments

To HAROLD L. MAXWELL, special assistant to management in the engineering service division, E. I. du Pont de Nemours & Co., on his retirement after 27 years of service. Dr. Maxwell joined Du Pont in 1930 to do metallurgical work at the Experimental Station and was soon doing consulting work at various company plants. In 1932 he organized a metallurgical group at Belle, W. Va., and in 1933 organized the materials of construction section in the technical division, later to become the Engineering Research Laboratory. He was appointed assistant director of the technical division in the engineering department in 1941 and became supervisor of mechanical engineering consultants in 1947. In 1952 he was named technical advisor for mechanical, utilities and management engineering, and in 1954 was appointed special assistant to engineering management.

Dr. Maxwell, a native of Iowa, graduated from Cornell College in 1916. Following service in World War I he took graduate work at Iowa State College, receiving his Ph.D. in 1924. From 1926 until 1930 he was associate professor of chemical engineering at Purdue University. In 1955 Cornell conferred an honorary doctor of science degree on Dr. Maxwell. A frequent speaker before technical groups and a contributor to many technical journals. Dr. Maxwell, a member of Philadelphia Chapter, plans to do consulting work and to write.

♦ ♦ ♦

To E. G. DE CORIOLIS on being named Engineer of the Year by the Toledo Technical Council at the sixth Annual Engineer's Week banquet. He has been director of research for Surface Combustion Corp. for the past 25 years.

♦ ♦ ♦

To B. R. NIJHAWAN on being appointed director of the National Metallurgical Laboratory, Council of Scientific and Industrial Research, Jamshedpur, India. He was also recently elected a fellow of the National Institute of Sciences of India.

♦ ♦ ♦

To NANCY LATENDRESSE, an 18-year old University of Michigan coed, on being the first girl to have won an industrial scholarship in the College of Engineering. The award is an International Nickel Co. scholarship for studies in the field of metallurgical engineering.

A.S.M. prepares and distributes, on request, preprints of the technical and scientific articles presented at the annual convention.

Outlines Developments In Aluminum Industry At Meeting in Pittsburgh

Speaker: H. R. Clauser

Materials and Methods

H. R. Clauser, editor, *Materials and Methods*, presented a talk on "Developments of New Materials and Processes" at a meeting in **Columbus.**

In recent years, of all the steels, the stainless types have been receiving the most attention from using engineers and designers. Unprecedented demands from both civilian and military users, coupled with a shortage of nickel, has led to the development of new low-nickel grades of stainless.

Perhaps the most significant of the new stainless steels are the high-manganese, low-nickel types (the 200 series). Whereas types 301 and 302, which they are designed to replace, contain around 8% nickel, the new steels contain only around 5% nickel. In general, the mechanical properties of types 201 and 202 are comparable to the properties of types 301 and 302. As far as strength and formability characteristics are concerned, types 201 and 202 can be substituted for types 301 and 302, respectively, and it also seems safe to substitute them where corrosion conditions are mild to moderate.

Recently, U. S. Steel has announced a new substitute for type 301 stainless, called Tenelon. It contains 0.10% C, 17% Cr, 14.5% Mg, and 0.40% N. This new steel is in commercial production but applications are in the development stage and fields of use are still being investigated.

Other nickel-free stainless steels are being developed. Ford Motor Co. is experimenting with a 16% Cr, 14% Mn, 2% Mo, ½% N steel for high-temperature service. Standard Oil of Indiana has been investigating steels containing from 21 to 33% Cr and has found that with high carbon and high nitrogen, such steels can be made completely austenitic at 2200° F. and higher.

For years the strength ceiling for steels was accepted as being around 200,000 psi., but now it is probable that strength as high as 350,000 psi. will be achieved.

One group of investigators has worked with standard steels and modified the heat treatment to obtain higher strengths. An example is the use of 4340 steel with a tempering temperature of 400 to 450° F., where the strength level is advanced to 270,000 psi. without a catastrophic drop in ductility.

Another group of workers has been developing steels of alloy content especially tailored to provide increased strength with a minimum of decrease in toughness. In general, these proposed steels have one or more of the following three factors contributing towards their higher strengths: They retain a low carbon content of around 0.40% as in 4340; their composition is modified to contain higher nickel than 4340; and silicon up to about 2% is added.

Magnesium is one of our promising metals. A recently developed magnesium alloy, HK-31, containing 3% thorium and 0.75% zirconium, is attractive for service in the 500 to 600° F. range, weighs one-fourth as much as steel, retains high strength and elastic modulus to temperatures of about 600° F., has good creep properties, can be heat treated and welded, and is available in cast or wrought form. These properties of HK-31 make it promising as skin material for aircraft.

Another alloy of the magnesium-thorium series containing 1.5 to 2.5% thorium and 0.35 to 0.80% magnesium has recently been announced and this metal extends the usable temperature range to around 700° F. and has 100-hr. creep strength around 3000 psi.

The aluminum industry's answer to moderately high temperatures may be aluminum powder metallurgy products, referred to as SAP or APM. Briefly, the development, by Alcoa, involves making wrought shapes from powder compacts composed of fine aluminum powder containing large amounts of aluminum oxide. The compact is rolled into sheet or extruded or forged to the desired shape.

APM products extend the useful range of aluminum by about 300° F. and up to around 1000° F. The tensile strengths range from 11,000 to 13,000 psi. at 900° F. after 1000 hr. at temperature. The high strength, thermal conductivity and melting point of these materials are expected to make them useful in pistons and cylinder heads for reciprocating engines.

In the field of high-temperature metals there has been no big breakthrough. For stressed applications such as gas turbines the designer is still limited to around 1600° F. The speaker emphasized that he was speaking of the so-called superalloys which include Cr-Ni-Fe, cobalt and nickel-base alloys. Molybdenum has high temperature strengths at 2000° F. that are better that the strengths of the best superalloys at 1600° F. However, molybdenum lacks oxidation resistance and rapidly deteriorates at temperatures over 1000° F. so that work in cladding, electroplating, sprayed metal coatings, and ceramic coatings is being done and shows promise.

Chromium-base alloys have been developed which are twice as strong as cobalt-base alloys at 1600° F., but the principal disadvantage is room temperature ductility.

Columbium and columbium-base alloys are quite promising since the structure is completely stable at high temperatures and has good oxidation resistance.

One of the most important coating developments in recent years has been the flame spraying of oxide and carbide coatings. Two techniques have been developed, one essentially the same as conventional metallizing, and flame plating.

The fastest growing family of plastics is ethylene polymers. Recent developments are high density and irradiated polyethylenes. The latter is currently being produced as tape, extruded tubing and rods, and it is reported that it will be used for wire insulation.

Polyamids which are a new addition to the nylons can be molded and extruded and find applications as gears. Others, called Versamids, have potential uses as coatings, adhesives, castings—potting and laminated resins as well as plastic solders and plastics tooling.

The use of plastic pipe has assumed large proportions in the last few years. Development of reliable fabricating methods and realistic engineering information has permitted sound designing.

A number of excellent slides and illustrations were used to supplement the presentation.—**Reported by R. S. Corder for Columbus.**

Peoria Hears Talk on Malleable Iron

F. B. Rote, Technical Director, Albion Malleable Iron Co., Presented a Talk Entitled "Malleable-Base Spheroidal Iron" at a Meeting Held by Peoria Chapter. At the speaker's table are, from left: J. M. St. John, secretary-treasurer; R. H. Hays, program chairman; J. G. Frantzreb, vice-chairman; Dr. Rote; and R. T. Brower, technical chairman

Given Women's Engineering Award

Rebecca Hall Sparling, Design Specialist for Convair Division, General Dynamics Corp., Received the 1957 Award of the Society of Women Engineers for Significant Contributions to Engineering. Mrs. Sparling, a member of the Los Angeles Chapter, is known for her work in high-temperature metallurgy, gas turbine development and nondestructive testing. She is shown supervising the insertion of a test specimen in the load cell of a high-temperature testing device. Shown with her is C. S. Rozen

Brittle Failure of Steel Plate in Large Structures Explained at Penn State

Speaker: M. Gensamer
Columbia University

"Brittle Failure of Steel Plates in Large Structures" was the subject of a talk given by Max Gensamer of Columbia University at a meeting of the **Penn State Chapter.**

Dr. Gensamer reviewed the history of failures of railroad bridges in Belgium, of storage tanks containing inflammables, and of the large number of liberty ships which failed in service during World War II. He pointed out that this type of failure relates in some degree to the type and quality of steel, but is more often dependent upon such factors as direction and state of stress, temperature and design. Plate thickness is also a factor, the danger of failure increasing with thickness.

The speaker then discussed the development of tests to evaluate the temperature dependence of the transition from tough to brittle behavior, including the keyhole and V-notch Charpy impact tests and V-notch, slow-bend tests, as well as the testing of portions of full-scale structures. He described and showed test results from a more recent test in which a wedge was placed in a V-shaped notch, and then a crack was propagated by firing a "gun" to drive the wedge into the notch. Test conditions can be varied by changing the charge in the "gun". This test method has permitted a study of the importance of "traveling" or "running" cracks.

Some correlation has been attempted between transition temperature and the influence of the common elements in steel. Phosphorus and silicon were shown to have no apparent connection with transition temperature. It has often been stated that manganese has a favorable influence on lowering the transition temperature, and that a high Mn/C ratio is desirable in this respect. Dr. Gensamer pointed out that he feels this is a misconception. He presented results to show that carbon is the principal element of influence on transition temperature, and that transition temperature rises with increase in carbon content. He stated his belief that the notion concerning manganese had arisen because of the higher manganese contents in low carbon steels as dictated by steelmaking practice and strength requirements. It is these low carbon steels which have low transition temperatures.

The speaker concluded with a discussion of the relation of flow and fracture stresses in the notch-bend, tension and tersion tests, and a discussion of a theory of crack propagation leading to fracture. He presented the Griffith-Orowan theory for the calculation of the stress needed to cause a crack to propagate in an infinite plate, then extended the theory to make it applicable to a finite plate. He showed that in an infinite plate any stress capable of causing a crack to propagate is also sufficient to cause the crack to travel all the way across the plate. In a finite plate, however, in a certain temperature range a stress may exist which can cause a crack to move, but which is not sufficient to keep it moving. A temperature at which a finite plate just begins to behave like an infinite one in this respect has been termed the "calamity temperature". The finite-plate modification of the theory also makes an explanation possible for the differences in transition temperature for the various tests, and explains why a fracture can be propagated under certain circumstances at stresses as low as half the yield strength or less. —**Reported by Donald Toland for Penn State Chapter.**

Explains How to Select Materials for Liquid Metal Services at Wilmington

Speaker: R. F. Koenig
General Electric Co.

R. F. Koenig, manager of the materials and processes laboratory, Missile and Ordnance Systems Department, General Electric Co., spoke on the "Selection of Materials for Liquid Metal Services" at a meeting held by the **Wilmington Chapter.**

Mr. Koenig reviewed the properties of various heat transfer media which explain the current level of interest in liquid metals for nuclear reactor heat transfer fluids. The limitations of water (i.e., temperature, pressure and film coefficients), are such that a system employing water as heat transfer medium would be extremely bulky and inefficient in most reactor conditions.

The same limitations do not apply to liquid metals but the use of metals does introduce special problems.

Considerations such as cost, availability and noncorrosive nature point to sodium as one of the better liquid metal heat transfer media for reactor cooling systems. Mr. Koenig described the equipment used to evaluate the materials of construction for cooling systems employing liquid metals. He pointed out the role of oxygen in accelerating the mass transfer effect, where container metals go into solution in a hot zone and are redeposited in cold sections causing blockage of process lines. These effects lead naturally to the conclusion that equipment design is extremely important for handling liquid metal in cooling systems.

While the extreme conditions of nuclear reactors have almost forced the use of liquid metal heat transfer systems, it is entirely possible that the advantages will be such that their use will be considered for commercial processes. — **Reported by N. E. Whitcomb for Wilmington.**

New Films

Die Casting—
How Else Would You Make It?

This 16-mm. sound color film is a visually graphic explanation of how designers are able to shape a better product and reduce costs by use of the die casting method. The versatility and scope of the process are shown by the vast range of shapes and sizes possible. The film, sponsored by the American Zinc Institute, Inc., is available free of charge to interested groups. Make application through Rothacker Inc., 729 Seventh Ave., New York 19.

Ductile Cast Iron

A color film, prepared by the International Nickel Co., Inc., shows the microstructure, the limits of stress and strain, and the properties of ductile cast iron. It is available through Rothacker Inc., 729 Seventh Ave., New York 19.

Two Heads Are Better Than One

A 16-mm., 18-min. color film which features the 680 series of multiple-head, conveyor-type abrasive belt grinders manufactured by Engelberg Huller Co. The film shows action sequences of various models in production on ferrous, nonferrous, plastic and other materials. The 680 series permits multiple grinding operations in the same time as formerly required for a single operation, with no added labor requirements. Address requests for the film on company letterhead, with name and title, to Engelberg Huller Co., Inc., 831 West Fayette St., Syracuse 4, N. Y., attention John Simmons, Product Manager.

Tells Albuquerque Members Of Nuclear Reactor Problems

Speaker: W. D. Manly

Oak Ridge National Laboratory

W. D. Manly, associate director, Metallurgy Division, Oak Ridge National Laboratory, presented a talk entitled "A Metallurgist Builds a Nuclear Reactor" at a meeting held recently by the **Albuquerque Chapter.**

Dr. Manly discussed the peculiar problems relating to the materials used in nuclear reactors, citing the nature of the problems and solutions to these problems. He described the design of a hypothetical reactor for powering an automobile to illustrate the problems encountered in reactor design. He pointed out that such a reactor is at the present time highly impractical because of such factors as cost, weight, size and safety.—**Reported by C. E. Arthur for Albuquerque Chapter.**

Describes Automobile of the Future

A. L. Boegehold (Right), General Motors Technical Staff, Spoke on "Materials for the Automobile of the Future" at a Recent Meeting Held by Detroit Chapter. He is shown with W. G. Patton, technical chairman of the meeting

Speaker: A. L. Boegehold

General Motors Technical Center

You'll have a piston engine in your car much longer than you think. A piston-type engine, having a much higher compression ratio than present passenger car power plants, will withstand the challenge of the free piston engine and the gas turbine for many years to come.

By 1980 die cast aluminum engine blocks will be used, replacing gray iron. Cost savings yet to be realized through the use of shell molding will eventually decide the competitive race between forged crankshafts and cast crankshafts in favor of the cast crankshaft.

Nickel will just about disappear as an alloying element in automobile shafts and gears. Molybdenum appears to be the most likely replacement.

The strategic materials problems involved in the production of the gas turbine will probably be solved. Some difficult performance problems remain unsolved, however.

By 1980, automobile radiators will be made of aluminum instead of copper.

These observations about the future of U. S. automobiles are the carefully considered conclusions of A. L. Boegehold, manager of research staff activities, General Motors Corp. While these predictions are Mr. Boegehold's personal views and do not constitute an official view of the General Motors Corp., the conclusions were supported by carefully compiled tables and charts showing population, fuel and materials statistics for the entire period extending from 1930 to 1980.

Detailed comparisons of the conventional piston, free piston and gas turbine engine were given in a talk on "Materials in the Automobile of the Future" by Mr. Boegehold in a talk before the **Detroit Chapter.**

Mr. Boegehold pointed out that transportation engineers are being pushed further and further in the direction of fuel and metals conservation. He says the power plant of tomorrow's motor car must be efficient to operate and build, it must use the smallest possible quantity of strategic and scarce materials, and it must have the lowest weight that is compatible with cost and the use of plentiful materials.

An automobile population of 88 million vehicles is foreseen by 1980, compared with 52 million vehicles in use today. The average car will be driven about 12,000 miles per year. Miles per gallon of gas will climb from 20 to 30 by 1980, according to Mr. Boegehold, despite an increase in horsepower from 180 to 250.

Probably the most enlightening information yet given the metalworking industry on the subject of future power plants is contained in a table showing fuel consumption, weight per horsepower, size and fuel requirements for piston engines, gas turbines, diesels and the free piston engine. The table shows that the gas turbine, considered by many to be the coming power plant, compares very well with the present-day piston engine in weight, but it will occupy less space.

Unfortunately, Mr. Boegehold pointed out, we need more information on how to get along with less nickel for turbine blades. Liquid cooling is not a practical answer.

Some form of die-cast aluminum engine blocks will be the basis for reducing engine weights. This is a logical extension of a development that has already occurred in automatic transmissions.

The use of more and more light alloys in automobile construction will take some pressure off the steel industry, Mr. Boegehold maintains, and he foresees 200 lb. of aluminum per car by 1980, compared with 35 lb. per car required today.—**Reported by Walter G. Patton for Detroit.**

Gives Jeffries Lecture in Cleveland

Shown at the Annual Zay Jeffries Night Meeting Held by the Cleveland Chapter Are, From Left: A. M. Montgomery, Aluminum Co. of America; Kent VanHorn, Director of Research, Aluminum Co. of America, Who Gave a Talk on "Precipitation Hardening"; and Ed Dyble, Chapter Chairman

Speaker: Kent Van Horn

Aluminum Co. of America

Kent Van Horn, director of research, Aluminum Co. of America, gave a talk on "Precipitation Hardening of Metals" before the **Cleveland Chapter** at the annual Zay Jeffries Night meeting.

Dr. Van Horn's discussion was primarily concerned with the effect of precipitation hardening on physical properties other than tensile strength and hardness. Properties such as resistance to corrosion, conductivity, susceptibility to growth and fatigue strength were considered.

The one set of conditions necessary to accomplish precipitation hardening is to have a phase or phases with solubility in a base metal that decreases with a decrease in temperature. The phase diagram and heat treating procedure for an aluminum-copper alloy were fully described. The same principles apply to all precipitation hardening alloys.

The accepted theory of the cause of hardness increase due to precipitation hardening is the formation of strains in the atomic lattice of the base metal by the precipitation of the insoluble phase. One additional requirement of a marked increase in hardness is that the atomic lattice of the precipitated phase must be different in type or size from the atomic lattice of the base metal. Dr. Van Horn predicted that a critical difference in lattice structure to produce optimum hardening would be established.

Alloys are less resistant to corrosion than pure metals, if surface phenomena are discounted, although solid solutions approach pure metals in this respect. In precipitation hardening, care must be taken to insure the precipitating phase being well distributed throughout the grain to eliminate intergranular corrosion.

Changes in corrosion resistance, susceptibility to growth, residual stress and conductivity do not correspond with changes in hardness or strength. Slides were used to illustrate these points. Consequently, data must be obtained on all properties under consideration, and compromises made to get the best possible combination of properties.—**Reported by J. J. Glubish for Cleveland Chapter.**

Speaks at Puget Sound on Stainless Steel Metallurgy

Speaker: E. J. Dulis

Crucible Steel Co. of America

E. J. Dulis, elevated temperature and high-temperature materials research, Crucible Steel Co. of America, gave a talk on the "Metallurgical Aspects of Stainless Steel" at a meeting of the **Puget Sound Chapter.**

Mr. Dulis described the various types of stainless steel and discussed in some detail the two new austenitic grades, AISI types 201 and 202. He also discussed the factors involved in the general corrosion, intergranular and transgranular corrosion, pit-type corrosion and stress corrosion of the different compositions when exposed to various service conditions. The methods of avoiding or minimizing these difficulties were also touched upon.

That the new and less expensive Cr-Ni-Mn grades have a definite advantage for some applications was pointed out. These steels with as much as 0.07% C resist rapid corrosion, whereas the Cr-Ni types have relatively poor resistance when the carbon content exceeds 0.03%. Under certain environmental conditions these new alloys are susceptible to pitting corrosion, and the only way for the determination of specific applicability is by service tests. Mr. Dulis summarized his talk with three points as a guide in the efficient selection of stainless steels for job suitability: to apply the principles developed to avoid corrosion of the material, to make suitable evaluation tests under simulated service conditions before selecting a steel for a new application, and to apply common sense in the design and fabrication of the various types and structures.—**Reported by Clement Walker for Puget Sound.**

Talks on Quality of Steel Castings

J. J. Kanter, Crane Co., Spoke on "Quality Requirements for Steel Castings" at a Meeting Held by the Texas Chapter. Present were, from left: Curtis Horn, vice-chairman; Mr. Kanter; and R. F. Goff, chairman

Metallurgical News and Developments

Devoted to News in the Metals Field of Special Interest to Students and Others

A Department of *Metals Review*, published by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio

Research Center—Rome Cable Corp. is currently building a $500,000 research center in Rome. The center will feature a complete pilot plant so that experimental production runs can be made without interrupting the normal production activities within the plant.

Course in Wear Theory—M.I.T. is sponsoring a summer session course in "Wear Theory in Metal Cutting and Bearing Design", from June 17-28. Information can be obtained from Summer Session Office, M.I.T., Cambridge, Mass.

Seminar—John Gaillard will hold a five-day seminar on "Industrial Standardization" from June 24 to 28 in the Engineering Societies Building, New York. Ten conferences, designed to assist management in the organization of standardization work and the training of staff in the art of writing specifications, will be given. Information from: John Gaillard, Box 273, Rt. 1, Briarcliff Manor, N. Y.

Announce Contract—Crucible Steel Co. of America has renewed its contract with the Air Force for the development of new high-temperature steels for use in jet aircraft, including a study of austenitic steels and their applicability for elevated-temperature service in aircraft and a study of metallurgical properties of bearing steels for aircraft use at elevated temperatures.

Powder Metallurgy Session—A seminar on "Powder Metallurgy" will be held in Duesseldorf, Germany, on June 27 and 28. Information may be obtained through: Geschaeftsfuehrung des Ausschusses fuer Pulvermetallurgie, Duesseldorf, Breite Strasse 27.

Stud Welding Award—A cash award of $1500, or $2000 in scholarships for any individual or school of the winner's choice, will be given for the year's most outstanding contribution in the field of semi-automatic electric arc stud welding. The award, sponsored by Gregory Industries, Inc., will be judged by A.S.M. President Donald S. Clark. The principal award will be made to the person responsible for the development of stud welding applications or studs which shall be judged most significant on the basis of reducing costs for industry, or improving the appearance, serviceability and life of a product or structure, or performing a function not possible by any other method. Individuals in any way associated with the manufacture, sale or distribution of stud welding equipment are not eligible. Entries must be postmarked by midnight, June 30, 1957, and should be mailed to Donald S. Clark, Chairman, Gregory Award Committee, 7301 Euclid Ave., Cleveland 3, Ohio.

Trade Fair—The 46th Annual International Trade Fair, to be held May 25 through June 10 in Paris, is expected to attract some four million businessmen and visitors from all parts of the world. Over 13,000 exhibitors from 39 countries will display 60 separate classifications of exhibits, ranging from heavy-duty construction equipment, agricultural machinery and refrigeration equipment, to plastics, office machines, housewares, textiles and luxury products.

Big Tank—The Metal Finishing Div., Frederic B. Stevens, Inc., has shipped what may be the largest processing tank for the anodizing of aluminum ever produced to Reynolds Metals Co. It is 26 ft. long, 5 ft. wide and 14 ft. deep.

New Toolsteel—A toolsteel that gives better machinability and at the same time a better finish is being produced by Allegheny Ludlum Steel Corp. The steel, Oilgraph-EZ, gains its improved combination of properties by the addition of a small amount of sulphur (0.10%) to the analysis of the steel.

Microanalyzer—An electron probe microanalyzer which can analyze minute areas of a large sample both quantitatively and qualitatively has been built by the French National Aeronautical Research Laboratories, and is being manufactured by Cameca Corp., Paris, and sold by Intercontinental Electronics Corp., Mineola, N. Y.

Armco Trains Germans—Specialized workers of the August Thyssen-Huette who underwent training at the Middletown, Ohio, works of Armco Steel Corp. are back in Germany transmitting their American experiences to their colleagues. The training plan is part of a mutual agreement between Thyssen and Armco to exchange technical assistance.

Thickness Gage—Branson Instruments, Inc., has introduced ultrasonic test equipment to which automatic detection and recording devices may be attached to spot thickness changes in metals and plastics as small as 5/100 of 1%, and which can be connected to ring an alarm, flash a signal light or activate compensating controls of various sorts.

To Build—Air Reduction Sales Co. will build a multi-million dollar air liquefaction plant for production of liquid oxygen, nitrogen and argon at Acton, Mass., near Boston. The plant is designed to produce 75 tons of liquefied gases per day.

Transducer—A surface-temperature transducer accurate between at least —320 and 950° F. has been developed by Charles Engelhard, Inc. The transducer consists of a woven grid of fine platinum wire and can be attached easily to any surface with a special di-electric cement, the grid interstices providing an excellent mechanical interlock.

Welding Technique—Dual Shield, a process which deposits weld metal three to twelve times faster than manual stick electrode welding and a conservative 33% faster than established semi-automatic methods, has been developed by National Cylinder Gas Co.

Radial Draw Forming—The basic structure of Convair's 615 mph. Golden Arrow 880 jet transport will be formed on a new 75-ton Bath radial draw former. The machine embodies a new principle of metal forming which will enable a manufacturer to make larger and more varied sections in one piece.

Interkama—The International Congress and Exhibition of Measuring Instruments and Automation will be held in Dusseldorf from Nov. 2 through 10, 1957. Information can be obtained through: Nordwestdeutsche, Ausstellungs-Gesellschaft M.B.H., Ehrenhof 4, Dusseldorf, Germany.

Cites Results of Nondestructive Tests

W. T. Bean, Jr. (Right) Research Consultant, Gave a Talk Entitled "Prediction of Serviceability by Nondestructive Testing" at a Meeting Held Recently by the Cincinnati Chapter. He is shown with M. C. LaBau

Speaker: W. T. Bean, Jr.
Consultant

W. T. Bean, Jr., research consultant specializing in stress analysis and design, addressed the **Cincinnati Chapter** on the "Prediction of Serviceability by Nondestructive Testing".

Mr. Bean presented a universal formula for scientific testing. Good data plus proper interpretation lead to results. He stated that often test results are political rather than scientific since the individual accumulates the amount and type of test data to satisfy preconceptions.

The prediction of serviceability can be separated into three phases—material, design and load analysis. Systematic evaluation of material, design and loads lead to proper applications.

As pointed out by Mr. Bean, nondestructive testing is meaningful only when correlation with destructive tests is evident. To enhance this correlation the speaker urged testing of functional components in their finished shape wherever possible.

He pointed out that tensile strength in itself is not a useful tool in predicting stress where good ductility is in evidence. A plot of yield strength or tensile strength versus hardness is preferred by the speaker. By using strain gages with a post-yielding cement, the data obtained allows for plotting of strain rate curves which present a more useful stress picture than conventional tensile test curves.

The speaker pointed out an example of how a ductile material can be made to produce a brittle failure with the proper type of notch, illustrating with S-N curves for a notched and unnotched ductile material.

Mr. Bean closed with the thought that strain is the common denominator in predicting serviceability and by relating strain obtained by testing in the final shape to our previous knowledge of material many facts about the evils of a particular component become available.—**Reported by J. H. Timmers for Cincinnati.**

Toledo Members Hear the History of Metallography

Speaker: R. J. Gray
Union Carbide Nuclear Co.

Members of the **Toledo Chapter** heard R. J. Gray, Union Carbide Nuclear Co., talk on "Metallography" at a recent meeting.

Metallurgy, as it is known today, is of comparatively recent origin and the development of metallography has followed on similar trends, absorbing convenient developments in microscopy, photography and X-ray diffraction techniques until it has reached its present position as an invaluable investigation tool. Some of the earlier contributory techniques, such as X-ray and electron diffraction studies, have formed specialist branches of their own.

Mr. Gray's talk covered the techniques related to specimen preparation and the subsequent techniques for optical and electron microscopy. The metallurgical microscope, with its reflected light system, has advanced far from the transmitted light system which permitted silhouettes of metal edges or, at most, oblique lighting. Paralleling the advancement of the reflected light system, the lens system has progressed with the fluorite lenses and the practice of surface coatings to permit higher magnification as well as better resolution.

The modern metallographic laboratory is equipped with the necessary cutting and mounting equipment to obtain the necessary size specimen and to provide a specimen holder during the polishing operation. At the present time, the metallographer is fortunate in having the special commercially prepared abrasives of aluminum oxide, magnesium oxide, chromium oxide and diamond dust, which have been carefully sized for various steps.

Many techniques have been developed for specimen polishing. The lead and cloth laps have become very popular and many special techniques have been added to meet the demands for the new metals and many alloys that are being developed.

The French physical chemist, Jacquet, advanced the study with his introduction of electrolytic polishing and etching. The more recent technique of vacuum cathodic etching has enabled the metallographer to etch samples which have been impossible by chemical or electrolytic means.

Photography has progressed to provide better films and probably there has been an even greater advancement in dark room techniques.

The greatest aid that metallography has provided has been the direct investigational nature of this field of research. The actual test sample from the corrosion, creep, or welding laboratory becomes the metallographic specimen. Then, by means of the artistic hand of the metallographer, a better understanding is obtained from the data derived from the previous test. The metallographer can be a part of the team from any department in metallurgy and through the development of color photography, hot stage microscopy, electron microscopy, cathodic etching and special corrosion studies he can carry out independent research projects.

Electron microscopy has become an important research tool to the metallographer in recent years. Special replication techniques have held back the electron microscope for metallurgical work as compared to biology; however, this development is now making the electron microscope a more common piece of equipment in the metallography laboratory.

Slides of equipment and the microstructure of Inconel welds, aluminum, aluminum-uranium alloys, uranium-carbon alloys, thorium and uranium, were shown to illustrate the above story on metallography. —**Reported by R. E. Hanslip for Toledo Chapter.**

A.S.M. is the largest publisher of books for the metals industry in the world.

Outlines Uses of Cobalt At Ottawa Valley Meeting

Speaker: F. R. Morral
Battelle Memorial Institute

"The Uses of Cobalt" was the subject of a talk given by F. R. Morral, division consultant, Battelle Memorial Institute, at **Ottawa Valley.**

Acknowledging that cobalt has many applications, such as those found in the chemicals, ceramics and glass industries and in the fields of nutrition, medicine and biochemistry, Dr. Morral proceeded to describe the uses of cobalt in commercial alloys.

At the present time the largest consumption of cobalt is for the so-called superalloys and for magnet materials. Other important uses of cobalt are for such applications as toolsteels, high speed steels and cemented tungsten carbides.

Cobalt-containing alloys are used in high-temperature applications such as gas turbines, jet engines and others. Dr. Morral predicted improvements as a result of continued metallurgical research and better fabrication techniques.

Further, the uses of stellites, a group of alloys containing cobalt, chromium, carbon, molybdenum and/or tungsten, were illustrated with slides which showed the numerous applications of these materials in a steel plant. Stellites have a wide range of hardness and ductility and, like cemented carbides, keep their cutting edge at high temperature. They combine corrosion resistance and resistance to high temperatures and, hence, they are used, amongst others, in naval searchlight reflectors and solar furnaces. Stellites have a high resistance to wear and some types are readily faced on steel, therefore they are often applied to steel surfaces requiring wear.

Cobalt is an important component of many magnet materials, particularly of permanent-magnet alloys; it is also a component of some magnetically soft materials and constant permeability materials. While mentioning that there was considerable work to be done on magnet materials, the speaker stated that, on the basis of the latest developments in this field, the uses of magnets can be expected to increase greatly in the future.

Only a very small amount of cobalt is used commercially as the pure metal. Cobalt has been rolled to foil 0.0008 in. thick and is drawn to wire, where one of its uses is as cobalt 60.

Dr. Morral pointed out that the world production of cobalt is increasing at a faster rate than its consumption, therefore, it should no longer be considered a scarce metal. He stated that cobalt deserves a good look by materials engineers since it has many desirable properties and it can be of great benefit when it is properly employed to take full advantage of these properties.

Dr. Morral's talk was supplemented by an excellent film on the production of cobalt at the plants of Union Miniere du Haut Katanga in the Belgian Congo.—**Reported by P. T. Todkill for Ottawa Valley.**

Describes Cast Irons at Purdue Chapter Meeting

Speaker: H. W. Lownie
Battelle Memorial Institute

"Cast Irons" was the subject of an address presented by Harold W. Lownie, chief, process metallurgy research, Battelle Memorial Institute, at a recent meeting at **Purdue.**

Mr. Lownie reviewed the iron-carbon diagram, with particular emphasis to that portion of the diagram concerning cast irons. He then described the characteristics of the four commercial cast irons, gray iron, malleable iron, nodular iron, and white iron. Of the four types, gray iron is by far in greatest demand and a considerable portion of Mr. Lownie's talk concerned the reason for this great demand.

The advantages for gray iron are low cost, low solidification shrinkage, excellent machinability, high vibration damping capacity, high compressive strength, high fluidity, no heat treatment required, excellent availability, wide range of permissible sizes, and excellent response to alloying additions. Mr. Lownie then went on to explain the reason for various applications. He also explained some of the advantages of malleable iron, including its higher strength, ductility and toughness, and also that of nodular iron, which deals principally with a higher level of mechanical properties.

Mr. Lownie concluded with a few remarks concerning things to be expected in the field of cast iron and indicated that, at the present time, development work is underway which will result in everyday availability of cast irons with tensile strengths up to and exceeding 180,000 psi.—**Reported by K. H. Schneck for Purdue Chapter.**

Performs Wire Rope Demonstration

Wire Rope Function in Excavation Is Being Demonstrated by Harry Truitt, John A. Roebling Sons Florida Representative, at a Jacksonville Meeting

A Country Fair presentation on wire rope was put on for the **Jacksonville Chapter** by four technical representatives of John A. Roebling Sons at a recent meeting.

The meeting started with a guided tour through the National Container Corp.'s mill. After dinner the group was divided into three sections, under the chairmanship of F. H. Ueckermann, Roebling's district manager. Harry L. Truitt, Florida representative, spoke on the uses of wire rope, explaining the broad areas of application and describing the best rope types for dragline, shovels, cranes, etc. Robert F. Mizaras, Alabama representative, discussed slings and rigging and described the various types of slings and the mechanics of single and multiple rigging. Grady Akins, Carolina representative, gave detailed explanations of the most popular wire rope constructions.

An unusual display of visual aid material, developed by Mr. Ueckermann, highlighted the meeting. These units graphically presented wire rope constructions in cross-section, demonstrated relative flexibility and rigidity of various types, and showed the service conditions involved in various applications. — **Reported by H. J. Huester for Jacksonville.**

Speaks on Ceramics Versus Metals

N. N. Ault, Ceramics Engineer, Norton Co., Spoke on "Ceramics Versus Metals" at the Past Chairmen's Night Meeting in Worcester. Shown are, from left: Walter J. Nartowt, vice-chairman; Mr. Ault; Lincoln G. Shaw, chairman; and N. P. Wakeen, technical chairman. (Reported by C. W. Russell)

National President Speaks in Buffalo

Donald S. Clark, President A.S.M., Presented a Talk Entitled "Yield Phenomena in Low Carbon Steel" at the National Officers and Past Chairmen's Night Meeting Recently Held by Buffalo Chapter. Sixteen past chairmen were present. Shown at the speaker's table are, from left: H. Jamesson; L. Yerkovich; President Clark; Matthew Hayes, present chairman

Rocket Engines Subject at Los Angeles

L. L. Gilbert, Aerojet-General Corp., Presented a Talk on "Rocket Engines" at a Meeting of the Los Angeles Chapter. Shown are, from left: Jack Dickason, chairman; Mr. Gilbert; and R. L. Heath, Rocketdyne Division of North American Aviation. Mr. Gilbert reviewed the various types of rocket engines that are now in current use, and summarized the materials employed in the major component parts. Specific application of the problem areas associated with rocket engines, particularly in the liquid engine field, were presented. (Reported by A. E. Cozens)

Bonding and Cladding of Metals Topic in New York

Speaker: J. G. Althouse

Lukens Steel Co.

J. G. Althouse, chief metallurgical engineer, Lukens Steel Co., spoke at a meeting of the **New York Chapter** on the "Bonding and Cladding of Metals".

Mr. Althouse reported that test data showing the unequal physical properties of the two dissimilar metals used in making clad steel plates did not introduce more stress factors at elevated temperatures than solid metals tested. Uniform stress characteristics are a vital factor in selecting materials for atomic reactor vessels.

In producing clad steels for atomic reactor vessels, a thin gage of stainless steel is bonded by a Lukens process using heat and pressure to a thicker gage of carbon steel. Thus, both the desired properties inherent in stainless and required strengths become available at a far lower cost than solid stainless of comparable gage.

Clad steels have been built into various "peacetime" atomic power plants and into Navy atomic submarines. Use of clad steels has permitted savings because of their economy compared with competing materials now in use.

The new research data reported by Mr. Althouse will appear later this year in a Lukens technical paper on the mechanical properties of clad plate pertaining to the design of atomic power vessels.

Twenty-five year membership certificates were presented to Janet Z. Briggs, director of technical information, Climax Molybdenum Co., Anthony W. Deller, patent counsel, International Nickel Co., Inc., and to C. M. Schwitter, Far Eastern and Latin American representative, International Nickel Co., Inc.—**Reported by V. E. Adler for New York.**

Talks on High-Temperature Evaluation at Wichita

Speaker: R. J. Raudebaugh

International Nickel Co. Inc.

At a meeting held by the **Wichita Chapter,** Robert J. Raudebaugh, head of the iron alloys research section, International Nickel Co., Inc., presented a talk entitled "High-Temperature Evaluation".

Mr. Raudebaugh discussed high-temperature applications and characteristics of stainless steels and the evaluation of materials for high-temperature service. He stressed particularly the nickel-bearing stainless steels plus the characteristics of the alloys with some vanadium.—**Reported by Jonathan Ewert for the Wichita Chapter.**

MEN OF METAL

HOWARD MEHR has been promoted to supervisor, industrial publicity, Selas Corp. of America. He assumes responsibility for the company's industrial publicity activities, which includes originating and preparing technical articles and conducting editorial relations with the business and industrial trade press.

HOWARD F. MESSICK has been appointed district sales manager, parts division, Sylvania Electric Products, Inc., Chicago.

P. W. MORSE has been appointed general sales manager for Magnethermic Corp. with headquarters at the company's plant in Youngstown.

EARL A. NEEB, formerly general superintendent of hot rolling and slab conditioning for Allegheny Ludlum, has been appointed plant manager of the new Toronto, Ohio, plant of Titanium Metals Corp. of America.

DAVID G. OSTERER was recently elected chairman of the board of directors, New Rochelle Tool Corp. He is also president and chairman of the board of New Rochelle Precision Grinding Corp.

H. B. PARFET, JR., has been appointed a sales engineer for Electro Metallurgical Co., a division of Union Carbide in the Chicago office.

MAURICE J. PHILLIPS has been appointed advertising manager for The International Nickel Co.

SAMUEL N. PRITCHARD has been named general sales manager for Henry Disston Division, H. K. Porter Co. Inc., to supervise sales activities of hardware, industrial and export departments in the United States and overseas.

ROBERT WALLACE STOKES has been appointed vice-president of Radio Frequency Co. Inc., Medfield, Mass. He has been with this company since 1950 and has been primarily responsible for expansion of the company's sales during that period.

OSGOOD J. WHITTEMORE, JR., a member of Norton Co.'s research and development department since 1946, has been appointed chief ceramic engineer of the refractories division.

CHARLES R. YERRICK has been appointed as eastern area industrial sales manager, adhesives and coatings division, Minnesota Mining & Manufacturing Co. He will make his headquarters in Bristol, Pa.

W. JACK HOFMANN is heading the Swiss Selas Corp. as general manager, with A. E. Baltus, who has been general European representative for Selas the past seven years, as sales manager.

Los Angeles Tours Anhauser-Busch

Members of the Los Angeles Chapter Combined a Plant Visit With a Social Event When a Tour of the Anhauser-Busch Brewery in Van Nuys Was Taken. Visitors were amazed to learn how much metallurgical research and know-how is required for the establishment of a multi-million dollar brewery. A barbecue beef dinner arranged by the brewery preceded the tour. Shown is one group of tourists enjoying a respite. (Report by A. E. Cozens)

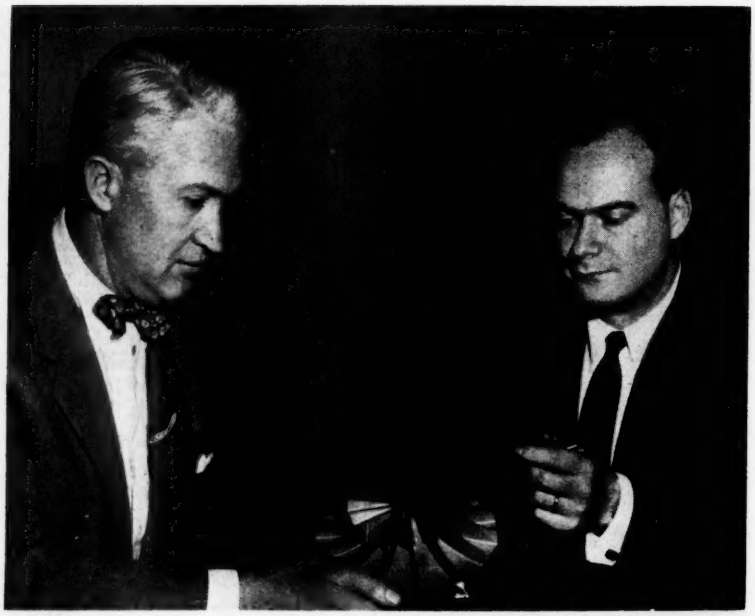
Old South Holds Picnic Meeting

Shown at a Picnic Lunch Meeting Held in the Home of Chapter Treasurer G. H. Ballentine, Jr., Are Some of the Members of Old South Chapter

Metallographic Exhibit at Rockford

As Many as 25 A.S.M. Chapters and Engineering Schools Have Had an Opportunity to See the 1956-57 Traveling Metallographic Exhibit of Winning Entries in the Metallographic Competition Held During the National Metal Exposition in Clevealnd Last Year. Pictured above is the exhibit at a meeting of the Rockford Chapter where it was recently shown

Tours Investment Castings Plants



K. W. Thompson (Left), President, Investment Casting Institute, Who Made a Tour of Member Companies in Cleveland Recently, Is Shown With F. W. Glaser, Executive Vice-President, Alloy Precision Castings Co., Discussing Techniques and an Exchange of Process Information About the Stainless Steel Impeller Cast by Alloy Precision's Frozen Mercury Process

Practical Aspects of Nodular Iron Presented At Meeting in Atlanta

Speaker: T. E. Eagan

Cooper-Bessemer Co.

T. E. Eagan, chief research metallurgist, Cooper-Bessemer Co., guest speaker at a meeting of the **Columbus Chapter,** discussed "Practical Aspects of Nodular Iron".

Shape, distribution of graphite and microstructure of nodular and gray iron were compared. In contrast to the flaked graphite microstructure of gray iron, photomicrographs of as-cast nodular iron showed small, round nodules of graphite encased in ferrite and dispersed throughout a matrix of pearlite. After annealing, the pearlite was changed to a silicoferrite.

A typical composition was given as carbon, 3.4 to 4.0%, silicon, 2.0 to 2.25%, manganese, less than 0.40%, phosphorus, less than 0.10%, nickel, 0 to 2.0%, and magnesium, 0.04 to 0.10%. It was found that traces of tin, lead, selenium, tellurium, copper and titanium (all additive) would not permit nodules to form; however, this was overcome by incorporating cerium in the melt.

The nominal as-cast properties showed tensile strengths around 90,000 psi., yield strengths of 67,000 psi., and per cent elongation around 6.2%. As-cast nodular iron, however, was found to be section sensitive showing significant drops in strength level as the section size increased. A ferritizing anneal, however, largely removed the effects of section size. Strength values obtained from hundreds of samples of annealed nodular iron remained consistently in the range of 64,000 to 67,000 psi. tensile, 46,000 to 50,000 psi. yield, 20 to 26% elongation, and Brinell 149 to 165.

Heat treatment procedures involved heating to 1700° F., holding 2 to 4 hr., cooling to 1275° F., holding at 1275° F., then furnace cooling to 900° F., after which the material was air cooled to room temperature. Quench and temper, and normalized and temper operations also were described. Oil quenched and tempered material showed strength levels according to the hardness developed. At Brinell 200, the tensile strength was 80,000 psi. and the elongation 10%. At Brinell 450 the tensile strength increased to 400,000 psi., the yield strength to 170,000 psi. and the elongation decreased to 1.0%.

Other interesting properties of nodular iron were also discussed. It was pointed out that the nodular iron stress-strain curve shows a definite straight line portion in contrast to the gentle curve of gray iron. Impact values of nodular iron at 20° F. and lower compare very favorably with values for cast steel and rolled steel at these same temperatures. Nodular iron also possesses a greater resistance to growth than does gray iron, and a greater resistance to scaling than do the 1020 and 1045 steels, or gray iron.

During melting operations, the proper amount of "alloy" (30% Si, 53% Ni, 15% Mg, 1.0% Cu, as one type of alloy) is added to a molten heel of low sulphur iron, and the balance poured over it. There is considerable slag from the magnesium present and it is tough to handle.

Typical applications for nodular iron were shown and described as the speaker concluded his presentation. Parts included large extension shafts, large hubs for earth moving machinery, 39,000-lb. autoclaves, pumps, engine blocks, crankshafts, pistons and gears.—**Reported by C. T. Olofson for Columbus Chapter.**

Tells How Industry Makes Use of Radio-Isotopes

Speaker: M. Eugene Merchant

Cincinnati Milling Machine Co.

M. Eugene Merchant, Cincinnati Milling Machine Co., presented a talk on the "Industrial Uses of Radio-Isotopes" at a meeting held by the **Chicago-Western Chapter.**

Industrial use of radio-isotopes is playing an increasingly important role in many fields of science and technology. They are used as a tool for measurement, and in the metal industry as a source of radiation and for tracing atoms with a Geiger counter. Several examples of their use as a source of radiation were described. Radioactive cobalt 6.0 is used for indicating liquid height and making radiographs to detect internal defects in metal parts and for measuring thickness.

The most important application of radio-isotopes is in the field of tracing atoms, and it has been used in the study of solid diffusion.

Its advantages in the study of wear problems include a great variety of applications where results were obtained in a short time with tremendous savings in time and money. Principal uses in wear studies are on such items as automobile engines, plastic molds, gears, wire drawing dies, hot extrusion dies and turbine blades. A case study of the use of radio-isotopes to the wear of cutting tools was discussed in detail. Radioactive lathe tools were used in lathe turning and the radioactivity of the chips measured. Results could be obtained after 30 seconds of cutting.

The method can be used to study the performance of different types of tools, the machinability of different grades of steel and the effect of different types of cutting fluids.—**Reported by M. F. Surls for Chicago-Western Chapter.**

Wichita Members Tour Plant

Members of the Wichita Chapter met recently for a tour through the plant and facilities of the Beech Aircraft Corp. Between 75 and 100 members and guests enjoyed the tour.

Describes Helicopters at Plant Visit in Hartford

Speaker: R. T. Spear
Kaman Aircraft Corp.

Kaman Aircraft Corp., Bloomfield, Conn., was the scene of **Hartford Chapter's** annual plant visit. About 100 were present for the visitation, and after viewing the manufacture and construction of helicopters in the factory, the group went outside on the heliport and watched a very interesting flight demonstration of a Kaman helicopter.

After dinner at Simsbury House, Richard T. Spear, employment manager for Kaman Aircraft, gave a talk on "Helicopters", which have been commercially available for about 15 years. He reviewed the history of the helicopter including the Chinese toy and da Vinci's model of the 15th Century. Early helicopter development failed because of three engineering considerations. Control, stability and torque had to be conquered before a practical vehicle was possible. Successful development coincided with the development of a practical gasoline engine. In the early 1900's, a Frenchman built a gasoline-powered machine with 12 rotors. This was undoubtedly the most complex design to fly. It wasn't until the autogyro of the 1920's that the first practical rotary wing machine flew successfully. Although the rotor was driven only by the forward motion of the machine, it helped in helicopter development because it incorporated the hinged blade, lead-lag hinges, and vibration dampers that are used in today's helicopters.

Mr. Spear classified helicopter configurations into four basic types: (1) single rotor, such as Sikorsky, which has to have a vertical tail rotor to counteract torque; (2) tandem rotors, such as Piasecki, which allows freedom of movement of the center of gravity; (3) co-axial, such as Gyrodyne, which has poor control characteristics in certain attitudes of flight, and problems with blade clearance; and (4) intermeshing, such as Kaman, which is an aerodynamically balanced system giving maximum control and stability. Kaman has a contract for a new utility helicopter, which will be a single-rotor machine. This machine will have greater speed than the intermeshing configuration, but will sacrifice stability.

The real secret of success for all helicopters is cyclic control of the rotor—the pitch of the blades is changed as they rotate through their 360° circle. In most helicopters this cyclic control is achieved through the mechanism in the rotor hub, but in the Kaman machine it is achieved through servo flaps near the tip of the blades.

On future developments of the helicopter, Mr. Spear mentioned the Hiller machine, which uses ram jets at the rotor tips for power and eliminates the torque problem. Also gas turbines as a source of power seem to have a big future because they require less installation space, weigh less, and operate most efficiently at full power, which is necessary in helicopter operation. Their main disadvantage at present is high fuel consumption, but development engineering is constantly reducing the fuel consumption.

After a color film showing the performance, capabilities and uses of the production HOK-1 Kaman helicopter, there was a question period. Two of the interesting items brought out in this discussion period were the altitude ceiling for Kaman helicopters, which is now about 18,000 ft., and the top speed, which is about 115 m.p.h.—**Reported by B. L. Taft for Hartford Chapter.**

Dayton Ladies Hear Talk on Stainless

A Complete Set of Stainless Steel Tableware Was Awarded as a Door Prize at the Dayton Chapter's Ladies Night Meeting. The lucky winner, Mrs. French, is being congratulated by the wife of the chairman, Mrs. McBride, on the right, and another smiling, but unidentified guest, on the left

Speaker: L. F. Lippert
Allegheny Ludlum Steel Corp.

The Annual Ladies Night meeting of the **Dayton Chapter** featured a talk by Louis F. Lippert of the Stainless Division, Allegheny Ludlum Steel Corp., on "Stainless Steel to Beautify and Simplify the Modern Home".

Mr. Lippert gave a brief history of the early development of stainless steel and explained its present meaning. Booklets which illustrated the numerous advantages of the noncorroding steels were presented to the members and their guests. Samples of tableware in each stage of manufacture were displayed as one of stainless steel's most attractive applications. Modern kitchens with various appointments of stainless were described and illustrated.

The portion of the talk dealing with cooking ware was a highlight for both the ladies and the men, for heat conductivity and design as related to ease of cooking were discussed. Solid stainless, clad steel and coated bottoms were described by the speaker. He continued by pointing out some of the uses of stainless in furniture, h a r d w a r e, appliances, sporting goods, automotive trim, etc., and some of the uses of stainless steel behind the scenes such as in processing equipment for producing synthetics, nylons, dacrons, rayons, etc., now used in carpets and drapes, all of which help to make the house more beautiful.

A complete set of stainless tableware was awarded as a door prize and each lady present was given a stainless steel scouring pad.—**Reported by R. A. Grayson for Dayton.**

To Present Course on Vacuum Metallurgy

The department of metallurgical engineering of the College of Engineering and the Office of Special Services to Business and Industry of New York University will present a one-week course on "Vacuum Metallurgy" from June 10 through June 14, at the University.

The course will cover sessions on Vacuum Systems and Physical Chemistry, Special Processes—Design and Operations, and Metallurgical Applications.

Complete program for the course and information on registration, as well as application forms, can be obtained by writing to: Dr. R. F. Bunshah, College of Engineering, New York University, University Heights, New York 53, N. Y.

Honeycomb Brazing North Texas Topic

"Stainless Steel Honeycomb Brazing" Was the Topic of a Talk Given by C. E. Rorick, Convair, at a Meeting of North Texas Chapter. Shown, from left: C. E. Perkins, secretary; Mr. Rorick; and J. P. Fowler, chairman

Speaker: C. E. Rorick
Convair

Members of the **North Texas Chapter** recently heard a talk on "Stainless Steel Honeycomb Brazing" by Charles E. Rorick, metallurgist, process control department, Convair.

A brief discussion of the problems encountered in modern high-speed aircraft, such as strength-to-weight ratio, high-temperature strengths, aerodynamic heating and aircraft weight increase was followed by a slide presentation. A solution to many of the problems is the honeycomb sandwich panel constructed of silver brazed 17-7PH stainless steel. Titanium alloys are under investigation for future use in honeycomb construction.

The history of the developmental stages of fixturing for brazing, atmospheres and the selection of brazing alloys was graphically illustrated to show the evolution to present processing methods.

The in-process control quality measures necessary for the production of the honeycomb construction were outlined in a detailed slide series showing each manufacturing operation in sequence. These operations include acceptance testing of raw materials, testing and evaluation of processing procedures, and surveillance of manufacturing operations.

The manufacturing operations involve honeycomb core milling, detail part fabrication, assembly of components by resistance tack brazing, followed by furnace brazing and heat treatment for maximum mechanical properties.

The internal quality of the honeycomb construction is evaluated by X-ray and heat-flash testing to check for defects such as an unbrazed or void area.

The weight advantage of the honeycomb construction was pointed out to be a savings of approximately 500 lb. per airplane over spot-welded plate and stringer construction. The smooth aerodynamic surfaces, ability to operate at high-service temperatures and weight saving characteristics of this type of construction may well lead to a more extensive use in future airframe construction. —**Reported by Stephen Maszy for North Texas.**

Discusses Heat Transfer Surfaces at Wichita Meeting

Speaker: R. E. Layton
O. A. Sutton Corp.

Robert E. Layton, past chairman of the Chapter, and superintendent of quality control, O. A. Sutton Corp., presented a talk on "Metallurgical Problems Encountered in Manufacturing of Heat Transfer Surfaces in Refrigeration Systems" at a meeting held in **Wichita.**

Mr. Layton gave an interesting discussion on heat transfer surfaces and showed several examples of cooling coils made by O. A. Sutton Corp.— **Reported by Jonathan Ewert for Wichita Chapter.**

Fetters Receives Medal

The Mahoning Valley Chapter recently had the honor of awarding the A.S.M. Medal to Karl L. Fetters for his distinguished service as a trustee. Dr. Fetters, assistant vice-president of the Youngstown Sheet and Tube Co., received the honor during a meeting of the chapter.

Metals Course Set Up at Wentworth

Mapping Plans for the New Metals Technology Course Which Will be Inaugurated at Wentworth Institute This Coming September Are, From Left: William F. Collins, Vice-Chairman, Boston Chapter; H. Russell Beatty, Wentworth President; Morris Cohen, Professor of Metallurgy, Massachusetts Institute of Technology; and Antoni Tabak of General Electric Co.

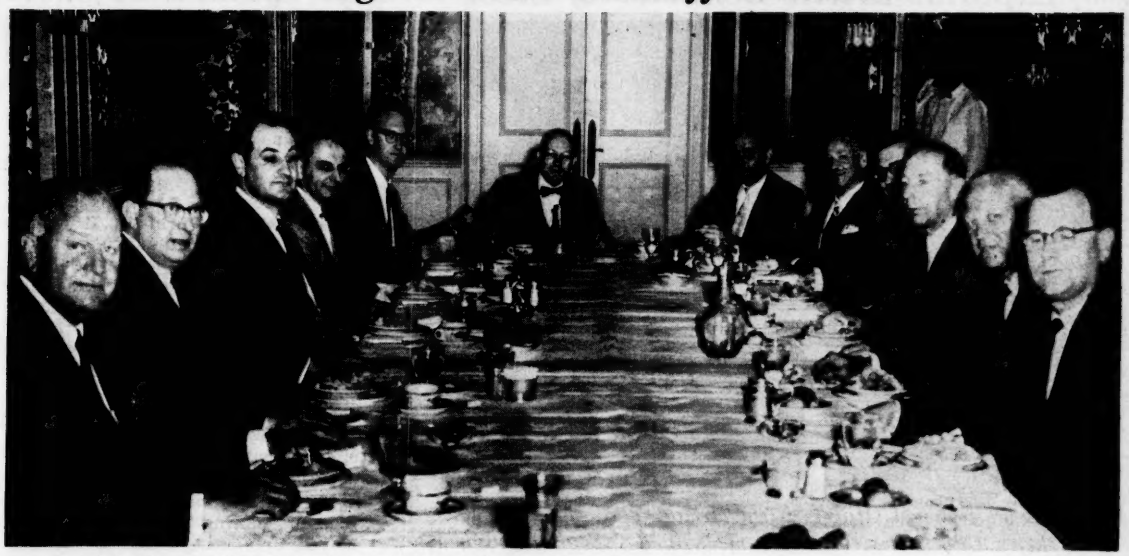
Largely through the efforts of W. F. Collins, vice-chairman of the Boston Chapter, working through the A.S.M. Committee on Vocational Education, a new course in Metals Technology will be inaugurated at Wentworth Institute, Boston, this coming September, according to an announcement by H. Russell Beatty, Wentworth president.

This new course is designed to train engineering technicians in metal processing industries. The course, two years in duration, leads to an associate in engineering degree. In the second year, the student has the option of specializing in foundry operations, metal fabrication or heat treatment of metals.

Graduates of this course, which is geared to meet the demands of New England's fast-growing metals industry, will qualify for positions as laboratory technicians, engineering assistants, production supervisors, methods analysts and technical salesmen in the metals processing industries or in the machinery and equipment industry.

This course is being added to the Wentworth Institute curriculum as the result of the A.S.M. Vocational Committee's initial special courses in Metals Technology for Teachers, and after a survey was conducted of New England metal industries which indicated a need for more trained technicians in this field of endeavor.

Los Angeles Holds Kick-Off Luncheon



At the Kick-Off Luncheon Held by the Los Angeles Chapter Preceding the Opening of the Western Metal Congress and Exposition in Los Angeles, National President Donald S. Clark and National Secretary W. H. Eisenman Were Guests of Honor. Shown during the meeting are, from left: F. H. Currie, Pete Ford, A. P. Binsacca, E. W. Golda, H. A. Curwen, Dr. Clark, J. Dickason, Los Angeles Chairman, Mr. Eisenman, Ed Egloff, R. E. Paine, R. D. MacMahon and A. E. Cozens. (Reported by A. E. Cozens for Los Angeles)

Points Out Advantages of Iron Powder Electrodes At Meeting in Columbus

Speaker: N. H. Dye
Lincoln Electric Co.

Members of the **Atlanta Chapter** heard a talk by N. H. Dye, southeastern district manager, Lincoln Electric Co., at a recent meeting on "Applications of Iron Powder Electrodes in Welding". He discussed the history, economy, usages and advantages of iron powder electrodes in electric arc welding.

Prior to the introduction of coated welding electrodes in 1929, welding was sparsely used and rather crude, using electrodes similar to baling wire. From 1929 until the beginning of World War II, electric arc welding was primarily used as a maintenance and repair tool, but exhibited new development and steady growth. The production requirements of World War II brought about an understanding of arc welding as a production tool. The development of the all-welded ship, tank and other necessary tools of war brought out the tremendous value of the arc welding industry.

Although arc welding developments since World War II have been many and significant, probably the most important development thus far has been the iron powder electrode. Jetweld, introduced at the Metal Show in 1953, was the first production iron powder electrode marketed in this country. It created a need for an entirely new set of electrode classifications and these have now been completed. Since this original introduction, many new classifications of iron powder electrodes have been introduced, marketed and are now being used in industry.

Comparison of the iron powder electrode and the conventional solid core electrode reveals that the iron powder electrode utilizes a considerably higher percentage of the arc heat, thus giving a more efficient operation. Its physical properties produce a weld which is considerably better than that made by normal electrodes in most cases. The appearance of welds made with iron powder electrodes is considerably better than those made with conventional electrodes. Proper cleaning of the finished weld is considerably easier on such welds, and, in fact, many such welds are practically self cleaning. Perhaps the greatest of its advantages is increased arc speed which is an inherent characteristic of iron powder electrodes. This manifests itself in considerably higher production and considerably lower welding costs.

The original cost of welding materials is almost insignificant in comparison to the total cost of welding. Labor and overhead comprise approximately 86% of total welding cost. On many applications, the use of iron powder electrodes can reduce the total cost by thousands of dollars. A $7.50 box of electrodes can cost as much as $300 before the electrodes are consumed into a useful or salable product. Slight differences in procedures, sizes, current, etc., can vary this as much as $100 per box in the total cost. Inherent characteristics of iron powder electrodes provide built-in production factors which make consistent quality, high speed and low cost much easier to achieve.

Hand in hand with iron powder electrode development has been the increased usefulness of alternating current welding. For the first time in the history of arc welding, production electrodes actually operate better on AC current. The use of AC current allows even higher production rates and better quality. Magnetic arc disturbance is reduced considerably by the combination of AC transformer welders and iron powder electrodes.

The arc welding industry is a rapidly growing industry. Many undeveloped uses in both the structural and machinery fields can now be achieved with a combination of AC welding and iron powder electrodes. **—Reported by J. W. Johnson for Atlanta Chapter.**

Talks on Materials

Speaker: J. D. Graham
International Harvester Co.

At a meeting held by the **Wichita Chapter,** J. D. Graham, chief engineer, materials engineering and engineering standards, International Harvester Co., gave a talk entitled "Materials Engineering".

Mr. Graham discussed general application of materials engineering, including specifications, stress analysis and fatigue analysis.—**Reported by Jonathan Ewert for Wichita.**

Explains Brittle Behavior of Steel

Shown at the National Officers Night Meeting of Rochester Chapter Are, From Left: Gilbert L. Cox, Chairman of the Education Committee; C. H. Lorig, National Treasurer, Who Spoke on "Brittle Behavior of Ferritic Steel"; N. J. Finsterwalder, Chairman; W. Albert Noyes, Jr., Dean of College of Arts and Sciences, University of Rochester; and R. F. Eisenberg, Professor of Metallurgy, University of Rochester

Speaker: C. H. Lorig
Battelle Memorial Institute

Clarence H. Lorig, technical director, Battelle Memorial Institute, and national treasurer A.S.M., spoke before the **Rochester Chapter** at its National Officers' Night meeting.

As a national officer, he brought greetings from the executive committee and expressed great pride in the Rochester Chapter for the scholarship established at the University of Rochester. He paid the Rochester Chapter a tribute in saying that this scholarship was an effort towards increasing the interest of students in making metallurgy their profession and told of the great need for metallurgists in the modern economy.

The technical part of Dr. Lorig's report was augmented with the aid of slides and dealt with "Brittle Behavior of Ferritic Steel". The mechanical concepts of brittleness in steel originally dealt with ductility properties in a tensile test. This neglects to consider lack of toughness which is a fundamental characteristic of brittle behavior. It is possible to classify metals as to their susceptibility to brittle behavior by their crystallographic structure. The body-centered cubic and hexagonal close-packed lattice are susceptible to brittle behavior whereas the face-centered cubic lattices are not.

Brittle behavior is a basic characteristic of ferritic steels. Contributing factors are decreasing temperture, low notch toughness and high notch sensitivity in the presence of notches and high stresses. As the temperature decreases, both yield and fracture strengths increase, with yield strength increasing more rapidly. When the two strengths are equal, the steel ruptures with no visual plastic deformation. The presence of a notch raises the temperature at which this occurs.

The mode of fracture changes as the material changes from ductile to brittle behavior. When ruptured in a ductile state, fracture occurs by shear and is preceded by considerable plastic flow along shear planes within the individual crystals. In a brittle failure, fracture occurs by cleavage wherein the individual crystals pull apart at cleavage planes without appreciable plastic flow. An intermediate range exists in which plastic flow occurs before a crack forms, but ultimate failure is by cleavage. Slides were used to illustrate the interrelationships shown by the various fractures contributing towards brittle behavior in ferritic steel.

Metallurgical considerations also strongly affect brittle behavior. Brittle behavior is particularly sensitive to changes in carbon and manganese contents, to minor changes in the amount of nitrogen and phosphorus present, to grain size, to deoxidation practice, to rolling practice and numerous other metallurgical variables. The manganese-carbon ratio was cited as being very significant in developing steel with outstanding resistance to notch embrittlement.—**Reported by R. E. Avery for Rochester Chapter.**

has an annual budget in excess of one million dollars.

Sets Up Scholarship

Rochester Chapter has announced the inauguration of a scholarship grant of $500 to assist a student in the University of Rochester's division of engineering to pursue a course in metallurgy. The Chapter plans to perpetuate the scholarship annually, to be given to a different student each year, according to N. J. Finsterwalder, chairman. It will be made available to an engineering student who has completed the junior metallurgy course, regardless of his major field of study, who is returning to the University in the fall for his senior year in engineering to take the fourth year metallurgy course. It will be given to the candidate who most closely complies with the University's standards and requisites of academic merit and financial need.

The grant was announced at a meeting during which W. Albert Noyes, Jr., acting dean of the University of Rochester's College of Arts and Sciences was a guest. In expressing the University's appreciation of the grant, Dr. Noyes stated: "One of the most urgent skilled manpower needs in this community and throughout the nation is engineers of all kinds. This scholarship and the motives which prompted it will serve as a real incentive to young men to engage in engineering studies".

Rockford Completes Course On Heat Treat Methods

"Heat Treating—Principles, Practices and Methods" was the subject of a five-lecture educational course recently completed by the Rockford Chapter. The course was comprised of the following talks:

Introduction to Heat Treating, by C. H. Muehlemeyer, president, O. T. Muehlemeyer Heat Treating Co.; General Heat Treating Equipment for Complete Piece Temperature Uniformity, by E. J. Pavesic, field metallurgist, Lindberg Steel Treating Co.; Temperature Measurement and Control, by Bruno Ramthum, Wheelco Division, Barber-Colman Co., and James Dunlap, industry sales manager, Minneapolis Honeywell Manufacturing Co.; Selective or Localized Heat Treating, by Robert J. Binder, supervisor of heat treating laboratory, Chrysler Corp.; and Surface Treatment of Metals, by Art Eklund, Jr., president, Eklund Metal Treating Co.

All men enrolled in the course received a copy of the book, *Principles of Heat Treatment,* by M. A. Grossmann, and those who completed the course were dinner guests of the Chapter at the April meeting.—**Reported by Joseph F. Sisti for Rockford Chapter.**

Report to Golden Gate Executive Committee

Our chairman, Bill Matheson, has asked for information regarding the Education Committee activities which could be placed in each of your hands for publicizing our efforts with the hope of increasing regular and sustaining membership support. Our activities have mainly centered around the following programs:

1. Metallurgical Seminars
2. Spring Lecture Series
3. High-School Lecture Demonstrations
4. Science Achievement Awards
5. Freshman Scholarships

Metallurgical Seminars

Donald R. Mash, Chairman

An outstanding series of nine monthly Seminars covering special subjects of interest to local technical people have been added to this year's educational program.

These seminars provide opportunities for informal technical discussion, wider acquaintance and the exchange of information among experienced people, as well as provide a source of up-to-date information on specialized aspects of metallurgy. The enthusiastic acceptance of these technical sessions indicates that they will probably become established as a part of the educational program for years to come. Members are notified as to the exact date and location by postcard prior to each meeting. Seminars held to date and those yet to be held are listed below:

No.	Date	Subject	Leader
1	Sept. 19	Controlled Atmospheres	Harry Lewis
2	Oct. 17	Ultrasonic Testing	W. J. Erichsen and panel
3	Nov. 28	Stress Corrosion of Stainless Steel	J. R. Cunningham
4	Dec. 19	Metal-Ceramic Bonding	J. L. Hall
5	Jan. 23	Welding Alloy Steel	O. T. Barnett
6	Feb. 27	Present Status of Ceramics and Cermets	R. M. Fulrath
7	Mar. 18	Properties of Metals and Their Relation to Metallographic Structure	D. R. Mash
8	May 3	Nuclear Reactor Materials (and Open House)	
9	June 19	High Strength Steels (or Vacuum Brazing)	

Spring Lecture Series

Malcolm McGregor, Chairman

The chapter's annual Spring Lecture Series, available to all interested technical people, dealt with the subject "Mechanical Properties and Their Effect on Service Performance of Metals". The series of lectures by authorities in this field held during the month of April, in four sessions, included the following: "Failure of Metals Under Repeated Stresses" (two nights), by O. J. Almen, retired, General Motors Research Laboratory; "Failure of Metals Under Constant Stresses", by D. C. Goldberg, Westinghouse Electric Corp., Aviation Gas Turbine Division, Kansas City and "Brittle Failure of Ductile Materials", by Earl Parker, University of California.

High-School Lecture Demonstrations

Robert Huggins, Chairman

The importance and attractiveness of metallurgical engineering as a profession is demonstrated to high-school science students in the area by means of lecture demonstrations held at Stanford University and the University of California. This is a joint venture between the Golden Gate Chapter and the individual universities. The first programs for students in San Francisco, San Mateo and Santa Clara Counties were presented at Stanford University in February, and similar programs were presented to students from Alameda, Contra Costa and Marin Counties at the University of California in March. Details regarding this program were mailed to all A.S.M. members with the March meeting announcement to keep them informed of the Golden Gate Chapter activities.

Science Achievement Awards for High-School Students

As a part of the program to interest science students in the metallurgical field, Science Achievement Awards, sponsored by the National A.S.M., are presented personally to local high-school students by individual Golden Gate members. This enables members to speak before student groups and better publicize A.S.M. and the metallurgical engineering field as a career.

Freshman Scholarships

Jim Dotson, Chairman

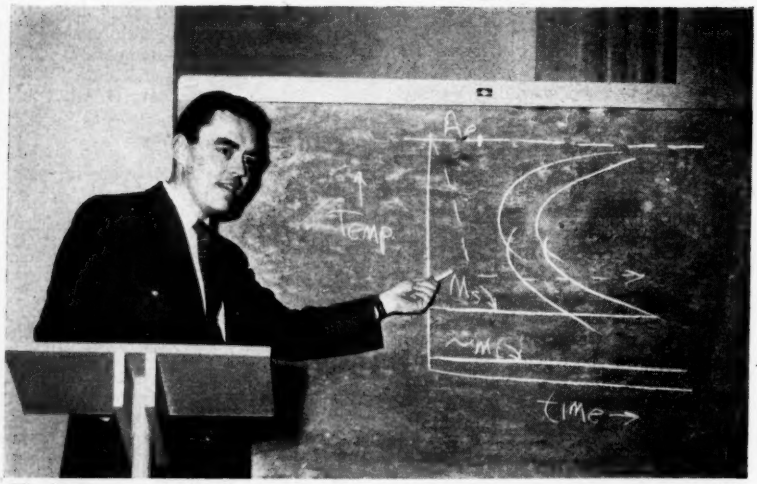
The Golden Gate Chapter annual freshman scholarship awards have been increased in value to $400 each. Coverage has been extended to include San Jose State College in addition to Stanford University and the University of California at Berkeley. The offers have been gratefully received. Professor Shepard of Stanford University has indicated that 34 applicants have discussed the grant with him. To quote him, "As a result, several of these men have already decided to major in metallurgy and there are ten others who are seriously considering a career in that field. This scholarship provides us with our best method of contacting freshman students and interesting them in metallurgy".

—Presented by Education Committee, Golden Gate Chapter, A.S.M., Wallace J. Erichsen, Chairman, James Anderson, Ben Berlion, Jim Dotson, Robert Failor, Robert Huggins, Donald Mash, Malcolm McGregor, Earl Parker, and Robert Ray.

Colorado School of Mines Officers

Student Officers Recently Elected by the Colorado School of Mines Chapter for the 1957-1958 Season Included, From Left: Bill Briggs, Vice-Chairman; Emmerson Kemp, Chairman; and Donald R. Rathburn, Secretary-Treasurer. Shown kneeling, front, is H. A. Hokanson, Chapter reporter

Presents Heat Treating Lectures



W. O. Harms of the University of Tennessee Is Shown During One of His Lectures on "Heat Treatment of Metals" Given Before Chattanooga Chapter

Speaker: W. O. Harms
University of Tennessee

The **Chattanooga Chapter** has just concluded its 1957 educational series which was attended by approximately 80 persons representing some 10 companies in and around Chattanooga that work with metals. The series "Heat Treatment of Metals" was presented by W. O. Harms, associate professor of metallurgical engineering, University of Tennessee, and consisted of six lectures.

The series began with a review of basic metallurgical concepts and went on through the principles of heat treatment of carbon steels. Later lectures covered heat and corrosion resistant steel heat treatment, precipitation hardening of steel and aluminum, copper, and nickel-base alloys. The last lecture was on the heat treatment of titanium alloys.

The series was well illustrated with slides and illustrations, and each student received a printed copy of notes of each lecture for future reference.—**Reported by J. H. McMinn for Chattanooga.**

Discusses Research Methods At Philadelphia Meeting

Speaker: H. T. Hallowell, Jr.
Standard Pressed Steel Co.

"Operations Research" was the title of an address delivered at the Sustaining Members night meeting of the **Philadelphia Chapter** by H. Thomas Hallowell, Jr., president, Standard Pressed Steel Co.

Development of titanium fasteners, with all of the ensuing trials and errors, was used as an example of the research process. This successful program resulted in filling the need for a light-weight, high-strength fastener for the aircraft industry. Research is useful if it increases profits and serves customers in the long run. It is necessary for progress in an integrated company because all future work depends on it.

After the engineers develop practical production problems, confidence in their findings must be established and plant and equipment must be available before information about the product can be released to the sales and advertising departments. Sales and advertising must coordinate their efforts very closely in proper release of test data and specifications to customers.—**Reported by George Clauser for Philadelphia.**

Titanium Is Wichita Subject

Speaker: Robert H. King
Republic Steel Corp.

"Titanium, Its Production and Applications" was the subject of a talk given by Robert H. King, Republic Steel Corp. in **Wichita.**

Mr. King discussed the methods of making titanium, going from research methods used only a few years ago to the present large-scale methods of manufacturing. He also described application problems related to titanium, including fabrication and welding problems.—**Reported by J. Ewert for Wichita.**

Thanks for Kind Words

The following letter was received by W. H. Eisenman, national secretary, recently, and is printed in full.

Dear Bill,

Silver Certificate to hand and very proud I am to have it.

As the pioneer of heat treatment in this part of the world, I can say that A.S.M. has been the greatest factor in the development and spread of sound understanding and methods and we are all very much your debtors. Regards and good wishes to all at headquarters.

Yours faithfully,
Arthur S. Reardon

IMPORTANT MEETINGS *for June*

June 2-7—Society of Automotive Engineers. Summer Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. (John Warner, Secretary, 485 Lexington Ave., New York 17, N. Y.)

June 9-13—International Automation Congress. Fourth International Automation Exposition, Coliseum, New York. (Richard Rimbach Associates, Management, 845 Ridge Ave., Pittsburgh 12).

June 10-11—Magnesium Association. Summer Meeting, Homestead, Hot Springs, Va. (Jerry Singleton, Executive Secretary, 122 E. 42nd St., New York 17).

June 13-14—Malleable Founders' Society. Annual Meeting, Broadmoor Hotel, Colorado Springs, Colo. (L. D. Ryan, Managing Director, 1800 Union Commerce Bldg., Cleveland 14, Ohio).

June 16-17—National Association of Metal Finishers. Annual Meeting, Sheraton-Mt. Royal Hotel, Montreal, Que. (P. P. Kovatis, Secretary, 60 Bently Rd., Cedar Grove, N. J.)

June 16-20—American Electroplaters Society. Annual Meeting, Sheraton-Mt. Royal Hotel, Montreal, Que. (J. P. Nichols, Secretary, 445 Broad St., Newark 2, N. J.)

June 16-21—American Society for Testing Materials. Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. (R. J. Painter, Executive Secretary, 1916 Race St., Philadelphia 2).

June 17-21—American Society for Engineering Education. Annual Meeting, Cornell University, Ithaca, N. Y. (W. Leighton Collins, Secretary, University of Illinois, Urbana, Ill.)

June 19-22—Drop Forging Association. Annual Meeting, Grand Hotel, Mackinac Island, Mich. (Richard Marcus, Secretary-Treasurer, 419 South Walnut St., Lansing 33, Mich.)

June 23-25—Alloy Casting Institute. Annual Meeting, Homestead, Hot Springs, Va. (E. A. Schoefer, Executive Vice-President, 32 Third Ave., Mineola, N. Y.)

June 27-28—Refractories Institute. Annual Meeting, Greenbrier, White Sulphur Springs, W. Va. (A. C. Newton, Executive Secretary, 1801 First National Bank Bldg., Pittsburgh 22).

Meet Your Chapter Chairman

MUNCIE

WILLIAM H. CHARLESWORTH, who was born in Paulsboro, N. J., graduated from Purdue University with a B.S. degree in engineering mechanics. His first job was as project engineer with Perfect Circle Corp. He was also supervisor of metallurgical laboratories and metallurgist and is now project engineer in general research with the same company.

Mr. Charlesworth was a captain in the Air Force from 1942 to 1946 in the Air Weather Service in the Caribbean and Asiatic theaters. While in the service he completed a course in professional meteorology at the University of California and graduated from the Tropical Weather School in the Panama Canal Zone. He is a member of A.S.T.M. and American Foundrymen's Society and takes part in community activities. He has a wife and three children and enjoys woodworking and golf as hobbies in his spare time.

NEW YORK

KEMPTON H. ROLL was born in New York City. His technical education was acquired at Carnegie Tech, Yale University and Brooklyn Polytech. His first work after school was in production metallurgy and he was a technical director before taking his present position as executive secretary and treasurer of the Metal Powder Association.

Mr. Roll has been chairman of the powder metallurgy group of the A.I.M.E. committee on metal powder plants, National Fire Protection Association and general conference chairman of the National Association of Corrosion Engineers. He is also a member of S.A.E., S.N.T. and Yale Engineering Association. From 1943 to 1946 he was in the U.S. Navy. He has two children.

SAVANNAH RIVER

SHELDON P. RIDEOUT was born in Ohio but, as he puts it, "close enough to the steel mills to smell metallurgy". Moving to Detroit at an early age tended to continue the metallurgical atmosphere and, after completing primary schooling in Detroit, Shel entered Michigan College of Mining and Technology at Houghton. Following graduation in 1948, he worked a year for the Ladish Co. at Cudahy, Wis.

It was then back to school as a research fellow at the University of Notre Dame and interesting work on high-temperature alloys under the direction of Paul Beck. In 1951, Shel received his M.S. degree in metallurgical engineering.

He then joined the du Pont Co.'s Atomic Energy Division and was assigned to the Argonne National Laboratories at Lemont, Ill., for preliminary training in atomic energy metallurgy. A year later, he moved to the newly built Savannah River Plant near Aiken, S. C., where he is currently a senior supervisor in charge of the metallurgical laboratories. Shel is married and has three children. His outside interests are many but church work is probably first in importance.

QUEBEC

HENRI P. TARDIF, a native of Canada, received his education at Laval University, Carnegie Institute of Technical and the University of Birmingham in England. He has worked as a helper on openhearth furnaces, assistant. metallurgist, metallurgist, and is currently head of the metallurgical laboratory, Canadian Armament Research and Development Establishment. He has been vice-chairman and chairman of the program committee of the Quebec Chapter and is a junior member of the Canadian Institute of Mining and Metallurgy. He also holds memberships in the English Speaking Union and Society of Mycology. He contributes technical articles more or less regularly to various papers and magazines.

He was 2nd Lieutenant in the Royal Canadian Engineers. He has two boys.

CALUMET

PHILIP H. BOOTH, a native of Worcester, Mass., received his B.S. degree in engineering at University of Illinois. His first job after leaving school was as a metallurgical inspector with Youngstown Sheet & Tube Co., and he has been with this company for 26 years, as laboratory foreman, assistant alloy metallurgist and alloy metallurgist. He has recently advanced to manager of bar sales in the Chicago office. He has been very active in A.S.M. affairs as vice-chairman, secretary and treasurer, plus other committee appointments. For recreation he enjoys golf.

CHICAGO JUNIOR GROUP ILLINOIS INSTITUTE OF TECHNOLOGY

LAWRENCE N. HJELM is a senior at Illinois Institute of Technology and attends Rensselaer Polytechnic Institute during the summer. He works as laboratory technician in the metallurgical engineering department at I.I.T. and is house manager for the Triangle Fraternity.

Lawrence hunts and fishes and is interested in autos, boats, golf, minerals and photography. He is in the Air Force R.O.T.C.

PENN STATE

Robert W. Lindsay, professor of metallurgy, The Pennsylvania State University, was born in Boston. He has degrees in chemical engineering from Tufts College, and metallurgy and physical metallurgy from Massachussetts Institute of Technology.

He worked in research and development with the Association of Manufacturers of Chilled Car Wheels and at the Sealed Power Corp., before going to Penn State as assistant and later as associate professor.

Mr. Lindsay has been continuously active in chapter affairs having been secretary-treasurer for the past five years and he was a member of the original group organizing the McFarland Award Committee, as well as on the technical committee of the recent biennial Pennsylvania interchapter meetings. He is on the national nominating committee this year.

His personal interests are hunting, fishing, baseball, golf and he enjoys recordings of classical music. His son is a sophomore in high school and the three daughters are second and eighth graders and a high school senior.

R. W. Lindsay *H. P. Tardif* *S. P. Rideout* *W. Charlesworth* *K. H. Roll*

A.S.M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad Received During the Past Month

Prepared at the Center for Documentation and Communication Research,
Western Reserve University, Cleveland,
With the Cooperation of the John Crerar Library, Chicago.

Annotations carrying the designation (CMA) following the reference are published also in *Crerar Metals Abstracts*.

General Metallurgy

161-A. Health Aspects of Welding. Humphrey Davy. *American Society of Naval Engineers, Journal,* v. 69, Feb. 1957, p. 76-80.

Suggested precautions and improvements of welding methods from the viewpoint of health. Low hydrogen method, submerged-arc welding, inert-gas metal-arc process, atomic-hydrogen process, carbon arc welding and brazing are discussed. 18 ref. (A7p, K1, K8)

162-A. Now Titanium Is Cheaper: Its Properties and Uses. *Engineering,* v. 183, Mar. 8, 1957, p. 298-300 (CMA)

The titanium products of ICI sell at 19s 6d, the lowest price in the world. The price of titanium has been halved in three years and world production is expected to exceed 30,000 tons in 1957. Other information on titanium extraction, melting, alloying, working and research was presented in papers read at the recent "Titanium in the Aircraft Industry" conference. Also discussed were corrosion and creep, galling and present uses. (A general; Ti)

163-A. Challenge of Titanium. *Iron and Steel,* v. 30, Mar. 1957, p. 85 +. (CMA)

Status of titanium and its technology in industry. Physical properties, fabrication, welding, brazing and machining. Supply, sponge production, and the direction of demand. Titanium may become competitive with stainless steel but will probably never be competitive with mild steel. (A general; Ti)

164-A. Scrap and Residues. S. W. Platt. *Metal Industry,* v. 90, Feb. 1957, p. 123-126.

Main sources of scrap; copper, tin, lead, zinc, cadmium, bismuth, white metals, solders, type metals, aluminum, magnesium and nickel, their segregation and treatment.
(A11d; Cu, Sn, Pb, Zn, Cd, Bi, Al, Mg, Ni, SGA-d, SGA-f, RM-p)

165-A. Dictionary of Metallurgy. A. D. Merriman and J. S. Bowden. *Metal Treatment and Drop Forging,* v. 24, Feb. 1957, p. 73-80.

Section from "Weirzin to X-Ray Spectra". (To be continued.)
(A general, 11-17)

166-A. Titanium Ores—the Present Picture. R. Quirk. *Mining Congress Journal,* v. 43, no. 3, March. 1957, p. 70-72. (CMA)

Titanium deposits are classified as rock deposits and beach sand deposits. Both may be exploited for ilmenite, but the rock deposits have an economic advantage in the salable iron ore products. Finnish, Norwegian, Canadian and New York rock deposits now worked are noted. Of prime importance in evaluating these deposits is suitability for the manufacture of titanium dioxide pigments. Beach sands depend for their value mainly on the rutile content. Australian, Indian and Floridian beach deposits are noted. (A11a; Ti, RM-n)

167-A. Safety Considerations for the Rolling of Uranium Sheet. James G. Stearns. Los Alamos Scientific Laboratory. *U. S. Atomic Energy Commission,* LA-2059, Dec. 1956, 10 p.

With regard to safety, the rolling of either normal or depleted uranium is the same; however, in addition to any safeguards applied to normal or depleted uranium, another factor, nuclear safety, must be considered when enriched uranium is rolled. Essentially, nuclear safety is the control of weight, shape and tamping factors of enriched uranium. In the preparation for and the allied equipment to be used with rolling processes, considerable planning must be carried out.
(A7p, A7r, F23; U)

168-A. Semi-Annual Summary Research Report in Metallurgy for January-June, 1956. Iowa State College. *U. S. Atomic Energy Commission,* ISC-759, Jan. 8, 1957, 42 p.

Purification and separation studies; alloy systems; metal coatings and corrosion; solid state investigations. (A general, A9)

The subject coding at the end of the annotations refers to the revised edition of the ASM-SLA Metallurgical Literature Classification. The revision is currently being completed by the A.S.M. Committee on Literature Classification, and will be published in full in late spring or early summer. A schedule of the principal headings in the revised version was published in the February issue.

169-A. Summaries of Physical Research in Metallurgy, Solid State Physics, and Ceramics. Edward Epremian. *U. S. Atomic Energy Commission,* TID-4005. Jan. 1957, 137 p.

Abstracts of papers in the following areas: (1) production, treatment, and properties of materials; (2) alloy theory and nature of solids; (3) radiation effects on materials.
(A general, N general, P18, 2-17)

170-A. (French and German.) **Information and Research Relating to the Applications of Tin.** B. Keysselitz. *Pro-Metal,* no. 55, Feb. 1957, p. 771-778.

Organization, aims and activities of the international Tin Research Council; enumeration of the properties and uses of tin; electrolytic deposition of tin and its alloys; excellent protection afforded by such coatings against corrosion; use of tin in the new copper alloys such as copper-tin-beryllium.
(A general; Sn, 17-7)

171-A. (French.) **Evolution of the Use of Molybdenum in the French Iron and Steel Industry.** L. Colombier. *Métallurgie et la Construction Mécanique,* v. 89, Feb. 1957, p. 105-111.

Three groups of molybdenum steels are currently used, structural steels, stainless steels and refractory steels. Outlines resistance of stainless steels to various reagents, behavior of refractory steels at high temperatures and indicates the improvements achieved by the addition of molybdenum in hardenability, resistance to annealing and reduction of brittleness.
(A general; AY, SS, SGA-h, *Mo*)

172-A. (Italian.) **Review of Principal Characteristics of Spheroidal Cast Iron. Part I.** Domenica Mensa and Matio Noris. *Ingegneria Meccanica,* v. 5, June 1956, p. 41-49.

Brief review of most important patents covering manufacture on a commercial basis. Metallurgical description of types most commonly used in mechanical construction. Physical and mechanical characteristics, with emphasis on most advantageous applications and economic aspects. (To be continued.)
(A general; CI-r)

173-A. Pearlite Malleable Iron in Canada. *Canadian Metals,* v. 20, Mar. 1957, p. 54-58.

Definition of properties, applications, method of manufacture and equipment used by International Malleable Iron Co. (A general; CI-s)

174-A. Transporation Control in Steelmaking. J. L. Kerins. *Iron and Steel Engineer,* v. 34, Mar. 1957, p. 134-137.

Transportation controls have resulted in improvement to many material handling methods and to extended use of special equipment. These controls have become preeminent as tools by which management plans, develops and installs dependable and efficient operating techniques that supply it with lowest cost transportation service. (A5b, W12; ST)

175-A. Titanium Industry in U.S.A. in 1956. T. W. Lippert. *Light Metals*, v. 20, Feb. 1957, p. 59-60.

1956 was characterized by steeply declining prices and record-breaking production volume. Industry continues to search for new extractive procedures. (A4p, C general; Ti)

176-A. The Long Struggle to Make Malleable Platinum. M. Schofield. *Metallurgia*, v. 55, Mar. 1957, p. 137-139.

Brief report of 400-year history of platinum with particular reference to work of Chabaneau and Wollaston. (A2; Pt)

177-A. Common Aluminum Alloys. M. W. Hall. *Modern Metals*, v. 13, Mar. 1957, p. 68-72.

Subjects discussed about nonheat treatable alloys include meaning of temper symbols, alloy designations, available forms, weight versus volume, work hardening, annealing and where to use various alloys. (A general, S22; Al)

178-A. Air Force Materials Research and Development Program. H. E. Hines and R. F. Walden. Wright Air Development Center. *U.S. Office of Technical Services*, PB 111648-S2, Oct. 1956, 94 p. $2.50.

Research in adhesives, metallurgy, analysis and measurement, biochemistry, textiles, petroleum products, plastics, packaging, protective treatments and rubber. (A general, T24, 17-7)

179-A. New High Temperature Intermetallic Materials. (Pt. 1). William Arbiter. American Electro Metal Corp. (Wright Air Development Center), *U.S. Office of Technical Services*, PB 111413, May 1953, 91 p. $2.

Details of preparation and testing of intermetallic compounds. A composition whose starting components were 95% chromium titanide and 5% chromic sesquioxide showed promising high-temperature properties, including good oxidation resistance and high stress-to-rupture strength. (A general; Cr, Ti, 14-18, SGA-h)

180-A. New High-Temperature Intermetallic Materials. (Pt. 2). William Arbiter. American Electro Metal Corp. (Wright Air Development Center), *U.S. Office of Technical Services*, PB 121018, Nov. 1953, 55 p. $1.50.

Details of preparation and evaluation of a large number of intermetallic compounds, some hard metal compounds and combinations of both. Compounds in the system titanium and silicon showed promise as potential high-temperature materials with excellent oxidation resistance at elevated temperatures. Chromium materials exhibited excellent stress-to-rupture behavior. (A general; Ti, Si, Cr, 14-18, SGA-h)

181-A. (Book.) **Metallurgical Information Meeting, Ames Laboratory, Iowa State College, May 2, 3, and 4, 1956.** Iowa State College. *U.S. Atomic Energy Commission*, TID-7526 (Pt. 1), Feb. 1957, 281 p.

Papers abstracted separately. (A general)

182-A. (Pamphlet—French.) **General Information on Aluminum and Its Alloys.** 47 p. 1955. *L'Aluminium Francais*, 23 Rue Balzac. Paris 8, France.

Method of symbolic designation of aluminum and its alloys; physical properties of aluminum compared with those of copper and iron; mechanical characteristics; chemical properties of aluminum; resistance to corrosion; principal commercial forms of aluminum and its alloys; information as to thickness and weight of such pieces; heat treatment. (A general; Al)

183-A. (Book—French.) **Metallurgy, Vol. II.** R. Cazaud. 202 p. 1957. Dunod, 92 Rue Bonaparte, Paris 6, France.

Concise pocket-pook covering many aspects of metallurgy. Subjects range from various methods of casting, rolling, stamping and drawing to heat treatment, methods of testing metals (mechanical tests, corrosion tests, microscopic metallography), analysis of the mechanism of corrosion, oxidation and protective coatings. (A general)

184-A. (Pamphlet—Spanish.) **Papers Presented at the 28th International Congress of Industrial Chemistry.** Institute for Scientific Studies, Juan de la Cierva Foundation for Scientific Study, Barcelona, 1956. 20 p.

Three papers abstracted separately. (A general)

185-A (Book—Spanish.) **Papers Presented at 3rd General Assembly of the Iron and Steel Institute.** Institute for Scientific Studies, Juan de la Cierva Foundation for Scientific Study, Barcelona, Spain. 1956. 37 p.

Papers abstracted separately. (A general; ST)

B Ore and Raw Material Preparation

29-B. Oxidized Copper. Part III. *Engineering and Mining Journal*, v. 158, March 1957, p. 80-84.

Problems of oxide flotation-smelting, oxide-leach-electrolysis, and oxide-leach-cementation, discussed from the viewpoints of recovery and cost estimation. (B14h, C19n; Cu)

30-B. How to Use This Modified Hallimond Tube—for Better Flotation Testing. D. W. Fuerstenau, G. D. Steel and P. H. Metzger. *Engineering and Mining Journal*, v. 158, March 1957, p. 93-95.

An improved laboratory flotation cell that gives reproducible results on 2-g. or 3-g. samples of 65 to 100-mesh feed has been developed by modifying the Hallimond tube. (B14h, 1-3)

31-B. (English.) **Fluidized-Bed Roasting of Pyrite.** Motoo Watanabe and Akiichi Kigoshi. *Tohoku University, Science Reports of the Research Institutes*, v. 8A, Dec. 1956, p. 512-531.

The problem of thorough utilization of domestic pyrite, which contains a small amount of cobalt, copper and zinc, the sulphatizing roasting process, which is based upon the preferential sulphatization by fluidized-bed reactor, was studied. (B15q; Fe, *Co*, *Cu*, Zn)

32-B. Differential High-Temperature Sulfatization of Cuyuna Manganese Ore. Charles Prasky. *Journal of Metals*, v. 9, Mar. 1957, *AIME Transactions*, v. 209, p. 377-380.

Progress report describes methods for concentrating low-grade manganese ore developed to pilot plant scale; process involves sulfur dioxide air roast followed by watered leach and recovery by evaporation and thermo decomposition of manganese oxide. (B15, C19n; Mn)

33-B. Importance of the Spinel Phase in the Steel Industry: Pt. 1. E. F. Osborn. *Industrial Heaating*, v. 24, Mar. 1957, p. 575-578.

Chemical and crystallographic aspects of spinels in refractories; phase relationships in systems of magnesia, iron oxide, silica at high and low oxygen pressures. (To be continued.) (B19; ST)

34-B. Flotation. *Industry and Engineering Chemistry*, v. 49, Mar. 1957, p. 493-696.

Literature review; particle-bubble adhesion, surface chemistry, electro kinetics and application of radioisotopes in research are emphasized. 51 ref. (B14h)

35-B. Roasting Reaction of Ferrous Sulfide. Kichizo Niwa, Tsuguyasu Wada and Yutaka Shiraishi. *Journal of Metals*, v. 9, Feb. 1957, p. 269-273.

Rate and mechanism of oxidation of ferrous sulphide studied by means of the spring balance and X-ray diffraction over the range of 500 to 700° C. Deficiency of iron ion occurs in initial stage of oxidation. Complete oxidation to oxides begins at 600° C. Above 600° C. rate of oxidation does not change with temperature, so rate-determining factor is diffusion of gas. 9 ref. (B15; Fe)

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36-B. Extraction of Tungsten From High Speed Steel Grinding Swart and Scale. F. H. Scott. *Metallurgia,* v. 55, Mar. 1957, p. 140-142.

Process for recovery of 80 to 90% of tungsten in grinding swarf or scale depends on oxidation of material and simultaneous fusion with sodium carbonate followed by precipitation with calcium chloride. Process economically feasible on pilot-plant scale. (B23; W)

37-B. High Voltage and Magnetic Separation. J. Hall Carpenter. *Mining Congress Journal,* v. 43, Mar. 1957, p. 62-65.

High voltage and magnetic separation methods in the ore dressing field; description of apparatus and its applications. (B14j; 1-2)

38-B. Filtration and Control of Moisture Content on Taconite Concentrates. A. F. Henderson, C. F. Cornell, A. F. Dunyon and D. A. Dahlstrom. *Mining Engineering,* v. 9, Mar. 1957, p. 349-354.

Study of filtration of the concentrate slurry prior to balling and hardening of pellets. Effect of drying time, filtration rate, cake thickness, vacuum level, feed temperatures, pulp grind size, pulp density and filter medium on the cake's moisture content. (B14q; Fe, RM-n)

C Extraction and Refining

91-C. Separation of Beryllium From Aluminum and Other Elements by an Extraction Method. J. P. Alimarin and I. M. Gibelo. *Journal of Analytical Chemistry of the USSR,* v. 11, July-Aug. 1956, p. 405-408. (Translation by Consultants Bureau, Inc., 227 W. 17th St., New York 11, N. Y.)

The extractability of acetylacetonates of aluminum, chromium, cobalt, iron, nickel, manganese, zinc, cadmium, lead, copper, calcium and magnesium by organic solvents (carbon tetrachloride, chloroform, n-butanol, and iso-amyl alcohol) in the presence of trilon B. 2 ref. (C28; Be, Al)

92-C. Some Problems About Adding Zirconium Through $ZrCl_4$ to Magnesium Alloys. S. Morozumi. *Light Metals* (Tokyo), v. 7, Jan. 1957, p. 55-62. (CMA)

Problems in alloying magnesium with zirconium by adding zirconium tetrachloride considered. Losses of lanthanon and thorium constituents were investigated. The fused salt $ZrCl_4$-KCl-NaCl is more stable to heat and moisture than is $ZrCl_4$. Aluminum, silicon and iron inhibit the alloying of magnesium with zirconium and according to their amount, cause a loss of zirconium tetrachloride. Unalloyed zirconium goes to the bottom of the crucible as zirconium-rich particles. (C5r; Mg, *Zr,* AD-n 32)

93-C. Electrolytic Titanium—II. R. S. Dean. *Metal Industry,* v. 90, Mar. 1, 1957, p. 165-167. (CMA)

Electrode potentials show that the alpha phase of titanium is less noble than the beta phase. Oxygen in titanium-oxygen may thus be anodically dissolved, leaving the metallic alloys in the beta phase. An example of this refining technique is given. Methods of preparing the electrolyte for this process, electrolyte maintenance and anode preparation are described. Aluminothermic reduction on a large scale is probably more practical for titaniferous ores and slags than Kroll reduction. Sorel slag readily forms a titanium-aluminum-iron alloy which is easily separated from oxide products after reduction. 4 ref. (C23p; Ti)

94-C. Recovery of Uranium From Magnesium Fluoride Volatility. G. I. Cathers and D. E. Ferguson. Paper from "Processing of Uranium-Magnesium Fluoride Slag", *U. S. Atomic Energy Commission,* TID-7528 (Pt. 1), Dec. 1956, p. 37-43.

It was found that reaction of magnesium fluoride slag with elemental fluorine at 400° C. volatilized 99% of the contained uranium, provided that good gas-solid contact was obtained. (C19r, B23; U, RM-q)

95-C. Separation of Niobium and Tantalum—Literature Survey. Ernest L. Koerner and Morton Smutz. Iowa State College. *U. S. Atomic Energy Commission,* ISC-793, Aug. 15, 14 p. ($15 from U. S. Office of Technical Services.)

Consolidation of the more important information available in the literature on the separation of columbium and tantalum, but only references which appear to have the most usefulness for future endeavors are included. 42 ref. (C28; Cb, Ta)

96-C. Carbonate Leach Recovery Process. R. G. Werkema. Paper from "Processing of Uranium-Magnesium Fluoride Slag", *U. S. Atomic Energy Commission,* TID-7528 (Pt. 1), Dec. 1956, p. 13-36.

A process for recovering uranium from a magnesium fluoride slag by means of carbonate leaching. A detailed analysis of the operating variables in this process as determined in pilot plant operation. (C19n, B23; U, RM-q)

97-C. Recovery of Uranium From Magnesium Fluoride Wastes by Ion Exchange. I. R. Higgins. Paper from "Processing of Uranium-Magnesium Fluoride Slag", *U. S. Atomic Energy Commission,* TID-7528 (Pt. 1), Dec. 1956, p. 44-53.

Ion exchange flowsheet for the recovery and partial purification of uranium based on the sorption of uranyl ion as a chloride complex on anion resin and its elution with water. 7 ref. (C19s, B23; U, RM-q)

98-C. Recovery of Uranium From Sulfate Residues of Magnesium Fluoride Slag. E. R. Johnson, R. L. Doyle, E. O. Rutenkroger and T. F. Rupert. Paper from "Processing of Uranium-Magnesium Fluoride Slag", *U. S. Atomic Energy Commission,* TID-7528 (Pt. 1), Dec. 1956, p. 54-80.

Studies designed to determine the relative merits of precipitating the uranium from sulphuric acid leach liquors of the sludge as (1) an ammonium diuranate-type compound, (2) uranous phosphate, (3) uranyl ammonium phosphate, and (4) peruranic acid. 6 ref. (C19n, B23; U, RM-q)

99-C. Progress Report on Separation and Recovery of Uranium and Thorium From Sulfate Liquors by the AMEX Process. D. J. Crouse, K. B. Brown and W. D. Arnold. Oak Ridge National Laboratory. *U. S. Atomic Energy Commission,* ORNL-2173, Jan. 11, 1957, 37 p.

The amine extraction (Amex) process can be used effectively for the extraction and separation of uranium and thorium from sulphate liquors in which these metals coexist. With proper choice of reagents, either uranium or thorium can be extracted first and the other extracted in a second cycle. Reagent costs are estimated to be low for both the uranium and thorium recovery cycles. (C19; U, Th)

100-C. Progress Report: Further Studies of the Dialkylphosphoric Acid Extraction (DAPEX) Process for Uranium. C. A. Blake, D. J. Crouse, C. F. Coleman, K. B. Brown and A. D. Kelmers. Oak Ridge National Laboratory. *U. S. Atomic Energy Commission,* ORNL-2172, Jan. 23, 1957, 113 p.

Progress is reported on certain aspects of the Dapex process, including further study of miscibility modifiers for the kerosene diluent, synergistic extractant combinations, stripping of extracted uranium, and continuous countercurrent demonstration on actual plant liquors. (C19; U)

101-C. Preparation of Ingots of U-Nb Alloy. O. N. Carlson, N. Ida, D. Peterson, F. Tate and H. A. Wilhelm. Paper from "Metallurgical Information Meeting, Ames Laboratory", May 1956. *U. S. Atomic Energy Commission,* TID-7526 (Pt. 1), Feb. 1957, p. 28-33.

A study was made of the preparation of a uranium alloy with 10% Cb by the bomb co-reduction of uranium tetrafluoride and a suitable form of columbium with calcium. A composition close to Na_2CbOF_5 proved to be most satisfactory as the source of columbium. (C26; U, Cb)

102-C. Preparation of Boron-Containing Alloys. A. P. Beard, J. W. Harrison and C. J. Beck. Paper from "Metallurgical Information Meeting, Ames Laboratory", May 1956, *U. S. Atomic Energy Commission,* TID-7626 (Pt. 1), Feb. 1957, p. 115.

Stainless steel base alloys with nominal compositions of 18% chromium, 14% nickel and 0.4 to 3.2% boron were successfully cast into ingots by vacuum induction melting. (C5j, 1-23; SS, *B*)

103-C. Aluminum-Boron and Aluminum-Uranium-Boron Alloys for Improved Reactor Performance. W. C. Thurber, J. A. Milko and R. J. Beaver. Paper from "Metallurgical Information Meeting, Ames Laboratory", May 1956. *U. S. Atomic Energy Commisssion,* TID-7526 (Pt. 1) Feb. 1957, p. 116-128.

The problems associated with melting and casting homogeneous aluminum and aluminum-uranium alloys with borides of aluminum and nickel are reviewed. The results reported include pertinent physical and corrosion properties of these alloys; extent of segregation; irradiation testing program; and manufacturing procedures established for incorporation of boron into aluminum fuel elements. (C5, P general, R general, T11g, 2-17; Al, U, *B*)

104-C. (French.) Preparation and Properties of Rare-Earth Metals. Felix Trombe. *Chimie et Industries,* v. 77, Feb. 1957, p. 277-288. (CMA)

Two principal methods of preparing rare earth metals are briefly described: (1) electrolysis of molten salts, sometimes (for elements beyond neodymium) using a metal of low melting point as a cathode, in which the rare earth metal dissolves and which is subsequently distilled off; (2) substitution of the

rare earth in a salt by another, more electropositive, metal, such as calcium. Certain differences in the properties of rare earths are pointed out; specific volume anomalies of cerium, both at high pressures and at low temperatures; the ferromagnetic behavior of gadolinium, dysprosium and erbium; and the antiferromagnetic properties of dysprosium at 180° K.
(C23p, C27, P general; EG-g)

105-C. (French.) **Electrolytic Cell for High Temperatures.** G. Chauvin, H. Coriou and J. Hure. *Metaux-Corrosion-Industries*, v. 32, Jan. 1957, p. 10-17.

Description of the construction and operation of a cell designed for the electrolytic preparation of zirconium. 13 ref. (C23, 1-2; Zr)

106-C. (German.) **Progress Realized in the Continuous Casting of Tin Bronzes.** E. C. Ellwood. *Giesserei*, v. 44, Feb. 28, 1957, p. 121-128.

Processes and apparatus for continuous casting of semifinished products for rolling mills.
(C5q; Cu-s, *Sn*)

107-C. (Italian.) **Developments in the Technique of Melting Light Alloys.** *Alluminio*, v. 26, Feb. 1957, p. 77-79.

Problem of avoiding inclusions, either gaseous or solid, in castings; origins of imperfections. Review of methods and equipment, with description of modern liquid and gas-fired furnaces, electric induction furnaces, reverberatory furnaces; advantages and problems with use of newer types of melting equipment.
(C5, W18; EG-a39, 9-19)

108-C. (Japanese.) **Studies on Electrolytic Refining of Aluminium at Low Temperature in Aluminium Chloride Baths (Part 12). Effect of Lead Chloride on the Electrodeposit of Aluminium and Crystal Structure of the Latter.** Rinzo Midorikawa. *Chemical Society of Japan, Journal*, v. 24, Dec. 1956, p. 562-567.

The addition of lead chloride is effective in improving the state of the electrodeposit. Crystal structure of the aluminum electrodeposits investigated by the X-ray diffraction method. 16 ref. (C23p, N12d; Al)

109-C. Some Aspects of the Physical Chemistry of Hydrometallurgy. J. Halpern. *Journal of Metals*, v. 9, Feb. 1957, p. 280-289.

Evaluation of various thermodynamic and kinetic factors influencing hydrometallurgical processes. Specific leaching and precipitation reactions are discussed in detail. 65 ref. (C19n, P12)

110-C. Ferromanganese From Low-Grade Ores. J. J. Burke. *Journal of Metals*, v. 9, Mar. 1957, p. 340-342.

Description of Udy process for production of ferromanganese and iron from ores which average only 12 to 13% manganese and 15 to 20% iron. Process depending on melting in reverberatory furnace and selective reduction in three electric furnace stages shows economic promise.
(C21c, C21d; Fe, Mn, AD-n)

111-C. Cobalt Pressure Leaching and Reduction at Garfield. J. S. Mitchell. *Journal of Metals*, v. 9, Mar. 1957, p. 343-346.

Principal steps in cobalt recovery from arsenical concentrates are auto-oxidation, acid leaching under pressure, filtration of tailings, purification of solution, hydrogen reduction of ammoniacal solution and melting in an electric arc furnace.
(C19n, C26, C21d; Co)

112-C. (Book.) **Processing of Uranium-Magnesium Fluoride Slag—Technical Information Meeting, Dec. 6, 1956.** Oak Ridge Operations Office, *U.S. Atomic Energy Commission*, TID-7528, Pt. 1, Dec. 1956, 80 p.

Papers abstracted separately.
(C general, B23; U, RM-q)

D Iron and Steelmaking

86-D. New Development in Ore Reduction and Steelmaking. H. B. Emerick. *Blast Furnace and Steel Plant*, v. 45, Mar. 1957, p. 313-318, and 344.

Developments of equipment and processes in U.S. and abroad, including direct fluidized solids reduction of iron ore, vacuum melting and casting, ore beneficiation, desulphurization of hot metals, basic oxygen furnace processes, rotor furnace processes, elimination of ingot defects, multiple-strand continuous casting. 14 ref.
(D general, B general; Fe, St)

87-D. Russian Research on Continuous Casting of Steel. Isotopes Used to Determine Depth of the Liquid Phase in the Ingot. R. Sewell. *Iron and Coal Trades Review*, v. 174, Feb. 15, 1957, p. 391-394.

Relationship between the depth and extent of liquid phase in the continuously cast ingot. (Based on article by V. S. Rutess in *Stal'*, Jan. 1956.) (D9q; ST, 14-13)

88-D. Waste-Gas Cooling and Fume Removal in the L-D Process. R. Kemmetmuller and A. Poppy. *Iron and Coal Trades Review*, v. 174, Feb. 22, 1957, p. 499-451.

One of the most serious difficulties in the L-D process (vertical oxygen injection in a stationary converter) is the removal of the large volumes of brown iron oxide fume from the waste gases; the latest developments in cooling the waste gases and extracting the fume are described. (D10a, A8a)

89-D. Combustion and Heat Transfer in an Open-Hearth Furnace. S. W. Pearson, M. W. Thring and J. H. Chesters. *Iron and Steel Institute, Special Report* no. 59, 1956, 82 p.

Data from trials on a Templeborough furnace covering the course of mixing, the roof temperature distribution, flame emissivity and temperature, metal temperature, and the furnace heat balance. Comparison between flow pattern and mixing in model and furnace; estimate of the extent of recirculation. (D2h)

90-D. The Need for Less Sulphur in Deoxidized Steel. H. W. McQuaid and Norman P. Goss. *Metal Progress*, v. 71, Mar. 1957, p. 65-71.

Since more than 0.020% sulphur in aluminum-killed, fine-grained steel produces undesirable ferrite in supposedly all-martensitic microstructures, the authors recommend that American quality steel manufacturers install special equipment for rapid desulphurization as is already being done in several European steelworks.
(D11n, ST, *S*, *Al*. AD-p35, 9-19)

91-D. Electric Furnace Steel Conference. E. C. Wright. *Metal Progress*, v. 71, Mar. 1957, p. 93-96.

Economics of the electric steel industry loomed large in the discussion, what with the excessively high cost of steel scrap. Other raw materials for the nonintegrated producer which were considered are sponge iron, hydrogen reduced iron, and desiliconized pig iron from cupolas. (D5, D9; ST, Fe, RM)

92-D. Making Quality Leaded Steels. *Steel*, v. 140, Mar. 11, 1957, p. 162-166.

Careful control of rate and timing of feeding lead into molten steel, content analysis by X-ray, spectrograph, improves quality of leaded steels. (D9r, S11c; ST, *Pb*)

93-D. (German.) **Principles and Results of the Production of Steel in the Rotor Furnace.** Rudolf Graef. *Stahl und Eisen*, v. 77, Jan. 10, 1957, p. 1-10.

Two steel producing methods in Europe; adaptation to changing economical conditions, e.g., ore supplies. Use of oxygen to obtain superior steel quality, free choice in the composition of the pig iron, high batch weights, prevention of smoke hazards. (D10; ST)

94-D. (German.) **Study of Physical and Chemical Processes Occurring During the Casting and Solidification of Steel.** Hans Kosmeider, Herbert Neuhaus, Hans-Joachim Kirschning and Werner Münstermann. *Stahl und Eisen*, v. 77, Feb. 7, 1957, p. 133-143.

Thermo-electrical measurements of the temperatures of the steel on its way from the furnace to its rise in the molds as ingots of 1.4 to 4.8 tons. Behavior of rimming steels during the boiling period. Degree of purity in regard to nonmetallic inclusions. Duration of the boiling period and segregation with different shapes of ingots. Behavior of the gases in rimming steel during its subsequent treatment. Radiological examination of the mechanism of solidification of killed steels.
(D9k; ST, 9-19)

95-D. (Italian.) **Influence and Evolution of Gases in Steelmaking Processes.** J. Massinon. *Metallurgia Italiana*, v. 49, Jan. 1957, p. 24-34.

Hydrogen and nitrogen only studied. (D11; ST, *H*, *N*)

96-D. The Climate of the Open-Hearth Furnace. J. H. Chesters. *Iron and Steel*, v. 30, Mar. 1957, p. 87-93.

Data on conditions in openhearth. Temperature measurements, levels, fluctuations and distribution, wind velocity and direction, variation in iron oxde fumes and depostion. (To be continued.) (D2h, 1-2)

97-D. Ironmaking in Japan. Kamekichi Wada. *Iron and Steel Engineer*, v. 34, Mar. 1957, p. 107-109.

Progress in equipment, technology and production since 1948.
(D general; Fe)

98-D. The Steel Industry and International Flame Research. M. Riviere. *Journal of Metals*, v. 9, Feb. 1957, p. 252-253.

Research on openhearth furnaces including heat transfer, rate of combustion and measurements to determine precise working of furnaces. 2 ref. (D2, D11)

99-D. Comparison of Blast Furnace Penetration With Model Studies. J. B. Wagstaff and W. H. Holman. *Journal of Metals*, V. 9; *AIME Transactions*, v. 209, Mar. 1957, p. 370-376.

Agreement on raceway size found between model work and measurements taken by rodding through tuyere of blast furnace. Data from blast furnaces were examined critically and variances between figures at different tuyeres and between furnaces were analyzed. Effect of operating variables on raceway diameter noted.
(D1b, W17, 17-6)

100-D. Some Notes on Iron and Steel Production in Sweden. J. Dunning. *Metallurgia*, v. 55, Mar. 1957, p. 131-132.

Developments in equipment and processing of ore and in steel production.
(D general, B general; Fe, ST)

101-D. (German.) **Construction and Operation of Modern 70-Ton Electric Arc Furnaces for Steel Melting.** Edmund Pakulla. *Stahl und Eisen*, v. 77, Feb. 21, 1957, p. 197-204.

Necessity for enlarging the crude steel basis; reasons for the selection of large capacity electric arc furnaces; description of an electric steel plant with two 70-ton electric arc furnaces, scrap yard, working, furnace and casting bays; characteristic data, design, operational results; comparison of the melting capacity with that of foreign electric arc furnaces; comparison of the output per hour of openhearth and electric arc furnaces. 8 ref.
(D5, W18)

102-D. (German.) **Importance of Scrap in the Production of Pig Iron and Steel.** Kurt Martin. *Stahl und Eisen*, v. 77, Mar. 7, 1957, p. 259-264.

The raw material "scrap"; correlations between pig iron and scrap charged for the production of steel ingots; scrap produced, marketed and re-used; the situation of scrap supply after the end of war.
(D general, A11a; ST, RM-p)

103-D. (Book—French.) **Reduction of Iron Ores.** R. Durrer. 152 p., 1957. Dunod, 92 Rue Bonaparte, Paris 6, France.

Analyzes various methods of reduction of iron ores and argues that the direct method is an economical alternative to the blast furnace.
(D1, D8j; Fe, RM-n)

E Foundry

104-E. Hot Blast Cuts Foundry Costs. *Steel*, v. 140, Mar. 11, 1957, p. 159-160.

Evaluation of case histories gave the following advantages for preheating cupola air blast compared to cold blast operations: coke savings of 10-15%, lower loss of iron, silicon and manganese from oxidation, more uniform chemistry, bridging eliminated, increased melting rate, lower sulphur content in iron, and iron is hotter at spout.
(E10a, 1-16; CI)

105-E. Flame Washing of Steel Castings. A. F. Chouinard. *Welding Journal*, v. 36, Mar. 1957, p. 219-224.

Oxy-acetylen flame washing of steel castings saves time, cuts cleaning costs, reduces handling of castings and facilitates better production control. (E24, 1-2; ST, 5)

106-E. (French.) **Die Casting—Some Factors Influencing the Rate of Production.** H. K. Barton. *Machine Moderne et Revue Mecanique*, no. 576, Mar. 1957, p. 57-61.

Among the features studied are the weight and size of the casting, method of ejection and the problem following extrusion. (E13)

107-E. (French.) **The Problem of the Utilization of Anthracite in the Metallurgical Operations of the Melting of Cast Iron.** Leon Delvaux. *Revue Universelle des Mines*, v. 13, Feb. 1957, p. 57-83.

Studies the poor resistance of anthracite to mechanical and thermal shock and suggests a solution to this problem by heat treatment previous to its utilization. 33 ref.
(E10; CI, RM-j42)

108-E. (German.) **Steel Castings With Creep Strength in the Medium and Elevated Temperature Range.** H. Zeuner. *Giesserei*, v. 44, Jan. 3, 1957, p. 1-7.

Characteristic values of the material and safety factors in the calculation of wall thickness. Creep strength of the typical cast materials in the medium and elevated-temperature range. 7 ref.
(Q8m; ST, 5, 17-1)

109-E. (German.) **Carbonic Acid of Limestone in the Cupola.** Hans Jungbluth and Alois Dahlmann. *Geisserei*, v. 44, Jan. 3, 1957, p. 7-13.

Different ways of eliminating the carbonic acid of the limestone. Approximation method and determination of the error originating therefrom. Special slide rules and nomograms for determining carbon dioxide and the wind volume. Conversion of the wind volume to normal conditions. 5 ref. (E10a, RM-q)

110-E. (German.) **Influence of the Mold Material and of the Alloy on the Solidification Time of Light Metal Castings.** E. Hesse. *Giesserei*, v. 44, Jan. 3, 1957, p. 13-17.

Influence of superheating, thickness of the casting, composition of the alloy, mold material, temperature and thickness of the chill mold, wash and sand mold on the time of solidification. 3 ref. (E25n, E22r)

111-E. (German.) **Contribution to the Problem of Increasing the Yield of Castings.** Werner Trommer. *Giesserei*, v. 44, Jan. 17, 1957, p. 37-45.

Importance of an increased yield as dependant on the properties of gates. Lowering the proportion of gates by directional solidification. Experiences with exothermic feeding materials to reduce the size of gates. Example for computing exothermic feeders. 28 ref.
(E22p, E22s, AD-p)

112-E. (German.) **The MTM System and Its Application to a Foundry.** Ivan Edman. *Giesserei*, v. 44, Jan. 31, 1957, p. 65-75.

Principles of the methods-time-measurement system. Examples of MTM analysis. MTM as a means of producing better castings. Machine molding of brake drums. MTM for adequate coordination of the operation of the finishing plants and predetermination of work standards. Simplified determination of job times by the aid of the MTM system.
(E general, A5d)

113-E. (German.) **Damage to Machines in Foundries.** Otto Neuhoff. *Giesserei*, v. 44, Jan. 31, 1957, p. 82-85.

General remarks on the causes of damage. Examples of damage caused by foreign substances, defects of the material or by faulty fabrication. Neglect of maintenance.
(E general, 18-21, 18-22)

114-E. (German.) **Effects of the Treatment of Molten Cast Alloys.** Karl Löhberg. *Giesserei*, v. 44, Feb. 14, 1957, p. 89-96.

Types of crystals; aluminum-silicon alloys; lead-antimony alloys. 38 ref. (E25q; Al, Si, Pb, Sb, 5)

115-E. (German.) **Effect of Sulphur on the Saturation Degree of Cast Iron and the Practical Use of the Saturation Degree in the Operation of a Foundry.** Paul Tobias and Horst Werner Wenig. *Giesserei*, v. 44, Feb. 14, 1957, p. 97-100.

Development from the introduction of the sum (carbon plus silicon) to the use of the saturation degree in the assessment of the quality of cast iron. Tests on the effect of sulphur. 12 ref. (E25, 2-10; CI-b; S)

116-E. (Italian.) **Elimination of Porosity in Castings by Treatment With Inert Gases.** *Fonderie*, v. 6, Jan. 1957, p. 19-21.

Research in American foundries has shown that the passage of a stream of nitrogen of a high degree of purity through a mass of molten metal provides a quick and inexpensive method of eliminating casting defects due to porosity. Used most frequently on nonferrous alloys, but there have been recent applications to stainless steels melted in induction furnaces. (E25q)

117-E. Core Making: the Neglected Back Room. Pt. 2. O. A. Scott. *Canadian Metals*, v. 20, Mar. 1957, p. 62-63.

Production and benefit of shell and green sand cores and advantages of di-electric core baking. (E21)

118-E. Sand Mould Penetration Testing. 1. A Simple Laboratory Apparatus for Estimating the Resistance of Sand Moulds to Penetration by Molten Metal. D. H. Houseman, D. V. Atterton and T. P. Hoar. *Castings*, Dec.-Jan. 1957, v. 3, p. 7-17.

Preparation of apparatus and technique for method employing mercury penetration and manometric measurement; comparison to green sand indentation method and estimation for degree of ramming and maximum molten metal head.
(E18r, 1-3)

119-E. Sand Mould Penetration Testing. 2. A Practical Comparison of the Effectiveness of Sand Compaction by Several Foundry Moulding Techniques. D. H. Houseman. *Castings*, v. 3, Feb. 1957, p. 13-21.

Compares sand compaction by hand ramming, pneumatic ramming, jolt squeeze and sandslinger with the use of mercury penetration tests. (E18r)

120-E. Quantity Production of Tractor Castings in Elektron. W. J. Sully. *Castings*, v. 3, Dec.-Jan. 1957, p. 29-36.

Composition, mechanical and corrosion resistant properties, sand preparation, molding, coring, melting and pouring practices for tractor transmission case cast from magnesium alloy. (E11, T3n; Mg)

121-E. Fifty Years of Art Founding. A. L. Parrott. *Foundry Trade Journal*, v. 102, Mar. 7, 1957, p. 301-309.

Brief reference to development in art casting processes and outline of present methods. Highlights and notable jobs during the 50 years of author's career.
(E general, A2, T9q)

122-E. Metallurgical Control of Quality in The Production of Aluminium Alloy Castings. A. V. Carless.

Institute of Metals Journal, v. 24, Feb. 1957, p. 227-235.

Information on aluminum casting alloys in general use. Prevention of contamination, precautions for material control and analysis, control of melting practice including preparation and maintenance of melting pots, degassing, grain refinement, temperature control, casting practice including gating, feeding, mold reaction, heat treatment and inspection including crack detection test and X-ray examination.
(E general, S13; Al)

123-E. Control of Quality of Magnesium-Base Alloy Castings. E. F. Emiley and P. A. Fisher. *Institute of Metals Journal*, v. 24, Feb. 1957, p. 236-254.

Comprehensive survey with emphasis on quality control includes information on alloys with zirconium or aluminum, avoidance of contamination and alloy loss, grain size control, fluxing procedures, pouring, molding, coring and running techniques and inspection methods, forging and elimination of defects, production of gravity die casting, heat treatment and suggested quality standards. 50 ref.
(E general, S12; Mg, *Zr*, *Al*)

124-E. (German.) **New Induction Furnaces in the Light Metal Foundry.** J. P. Rohn. *Aluminium*, v. 33, Mar. 1957, p. 170-172.

Comparison of horizontal channel induction furnaces with other types of furnaces. Description of a tiltable two-chamber furnace for a piston foundry, and a low-frequency induction furnace of 3½ tons capacity. 3 ref. (E10r, 1-2; Al, Mg)

125-E. (German.) **Recent Melting Equipment for Light Metal Foundries and Its Economical Importance.** H. Heimann. *Aluminium*, v. 33, Mar. 1957, p. 173-174.

Description of a fixed and a tiltable crucible furnace for melting metal for fairly small castings and of a holding and melting furnace for pressure die casting. All furnaces are gas or oil heated.
(E10, 1-2; Al)

126-E. (German.) **Development of Pressure Die Casting Machines.** F. Heinrich. *Aluminium*, v. 33, Mar. 1957, p. 175-179.

Economical and technical importance of pressure die casting. Design characteristics of cold and hot chamber machines. Semi or fully automatic control. Interchangeable unit system with main and various subsidiary units. (E13, 1-2)

127-E. (German.) **How to Calculate a Self-Computing Chart for Advance Times in the Assembly of Wax Clusters.** Eduard Haab. *Werkstatt und Betrieb*, v. 90, Feb. 1957, p. 141-144.

Description of calculation of a self-computing chart for quick determination of advance times. Example of wax cluster assembly for wax melting process in precision casting practice. (E15)

129-E. (Pamphlet—French.) **Practical Information on the Casting of Aluminum and Its Alloys.** 71 p. 1956. L'Aluminium Francais, 23, Rue Balzac, Paris 8, France.

Lists standard compositions of light alloys; properties and applications of the principal compositions used in casting; mechanical characteristics; analysis of the melting process (correct composition, absence of oxide); techniques employed; types of flux and their application; pyrometry; types of ovens and heating methods; sand casting and chill molds; defects in pieces together with appropriate remedies; heat treatment. (E general; Al)

Primary Mechanical Working

70-F. (Swedish.) **Inductive Block Heating With Current of Low Frequency.** Bo Estberger. *Teknisk Tidskrift*, v. 86, Dec. 4, 1956, p. 1059-1061.

Inductive heating of blocks for pressing cylinder blocks. The method could be used also for other purposes. (F21b, 1-19)

71-F. Production and Fabrication of New AISI Types 201 and 202. G. W. Hinkle. *ASTM Bulletin, No. 229*, Feb. 1957, p. 47-50.

Conversion of ingot to sheet and strip product is more time consuming. More power is required for hot and cold rolling. Annealing, pickling and cold rolling practices must be changed to produce commercial quality strip and sheet product; in deep drawing and spinning, changes must be made in tool design, power and blank size.
(F23, G4b, G13; SS)

72-F. Rolling With the Hot Planetary Mill. H. M. Walter. *Iron and Steel*, v. 30, Mar. 1957, p. 95-100.

Investigation using plasticine for study of material flow in planetary mill. Feeding speeds were varied and effect of roll size, slab thickness, temperature, slip forward or backward, angle of bite and scale distribution on material flow was recorded. (F23, W23)

73-F. Non-Slip Point in Rolling. Z. Wusatowski. *Iron and Steel*, v. 30, Mar. 1957, p. 109-111.

Comparison of experimental results obtained on cold or hot rolling of aluminum, copper or soft steel with the values for the angle of nonslip point calculated by seven methods from literature and by author's method. (Concluded.)
(F23; Al, Cu, CN)

74-F. Edge Position Control for the Steel Strip Industry. Frank J. Markey. *Iron and Steel Engineer*, v. 34, Feb. 1957, p. 119-131.

Design details of a continuous process line when edge control is applied to either the pay-off or wind-up reels, or at some intermediate point within the process.
(F23, X13; ST)

75-F. An Electrical Analogue for Estimating Die Temperatures During Wire Drawing. A. E. Ranger. *Iron and Steel Institute Journal*, v. 185, Mar. 1957, p. 383-388.

Temperatures of the outside of the die pellet were measured during wiredrawing and the temperatures of the interior surface of the die in contact with the wire were then computed by means of an electrical resistance network analogue of the thermal system. The most significant finding is that external cooling of the die is far less important than cooling its inlet, to prevent overheating of the soap powder before it enters the die. 6 ref. (F28, S16s)

Secondary Mechanical Working

Forming and Machining

123-G. Advanced Tooling Speeds Tiger Production. John P. Wright and Gosta M. Wernberg. *American Machinist*, v. 101, Mar. 11, 1957, p. 129-144.

Case histories of several processes used at Grumman in production of supersonic fighter including machining, forming, honeycomb adhesive bonding and alkaline descaling with periodic polarity reverse.
(G general, K12, L12k)

124-G. Machining C-1144 Severely Cold Worked Stress Relieved Steels. Andrew Kondrath. *Automatic Machining*, v. 18, Mar. 1957, p. 44-45.

Data on machining characteristics giving speeds and feeds of stress-relieved resulphurized screw stock steels. (G17k; ST, SGA-k)

125-G. How Much Do Grinding Fluids Affect Wheel Performance? (Pt. 2). J. A. Mueller. *Iron Age*, v. 179, Mar. 7, 1957, p. 134-135.

Grinding test designed to measure relative efficiency of fluids applied in conventional manner, or introduced through grinding wheel, or as mist from nozzle. (G18; NM-h)

126-G. Cutting Tools: Great Promise for New Materials. R. T. Hook. *Iron Age*, v. 179, Mar. 14, 1957, p. 134-136.

Titanium carbide cutting tools yield finer finishes at faster cutting rate than tungsten carbide. Titanium boride and molybdenum boride show promise in cutting superalloys and have the low weld-on tendencies. Cemented ceramic tips used for machining some difficult alloys—improvements needed.
(G17, T6n, Ti, Mo, C, 6-19)

127-G. Why Leaded Forgings Favor Machinists. *Iron Age*, v. 179, Mar. 14, 1957, p. 138-139.

Mechanical properties and machining comparisons on 1075 leaded or regular carbon steel. Leaded materials machine 31-58% faster.
(G17k, Q general; CN, *Pb*)

128-G. Special Theory of Ultrasonic Machining. George E. Miller. *Journal of Applied Physics*, v. 28, Feb. 1957, p. 149-156.

A model is proposed for the mechanism of material removal in ultrasonic machining. From this model and fundamental physical principles, a machining rate equation is derived for the special case where solid, circular tools are used in conjunction with a puddled slurry. Suggestions for improvement of ultrasonic machining processes. (G24c)

129-G. Possibilities of Ceramic Tools. *Machine and Tool Blue Book*, v. 52, Mar. 1957, p. 145-159.

Progress reports describe tests and results made by Boeing, General Motors and Ford to investigate value of ceramic tools for machining of regular and ultra-high strength steels and titanium alloys.
(G17; AY-n, Ti, SGA-j)

130-G. Titanium Carbide. W. E. Montgomery. *Machine and Tool Blue Book*, v. 52, Mar. 1957, p. 160-161.

Tests show tools from titanium carbide with molybdenum carbide bonded with nickel have exceptional

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crater and edge wear resistance with cutting speeds approaching ceramic tools. (G17, T6; Ti, 6-19)

131-G. Oils for Cutting Operations. A. E. Lawson and E. G. Ellis. *Petroleum,* v. 20, Mar. 1957, p. 99-102.

The advent of automation has increased the demands which are made on cutting oils, materials which have always required particular care in manufacture and selection for different operations. Review of recent developments in the field of cutting oils with regard to materials, testing and application. (G17; NM-h)

132-G. Forming Titanium and Titanium Alloy Sheet by Stretching and Other Methods—I. R. A. Kiehl. *Sheet Metal Industries,* v. 34, March 1957, p. 215-223. (CMA)

Recommended practice. Subjects covered are the benefits of pre-etching, the use of simplified heat treatment fixtures, technical data on titanium sheet, notch sensitivity and formability, advantages of different types of rubber forming, stretch and shrink flanges, springback and distortion. (G9, Q23q, Ti)

133-G. Fundamental Concepts of Oxygen Cutting. R. L. Stoecker and W. B. Moen. *Welding Journal,* v. 36, Mar. 1957, p. 151s-156s.

Chemistry and kinetics of the cutting action, gas dynamics of the oxygen stream, heat transfer mechanisms and related phenomena governing metal removal by an oxygen jet. 19 ref. (G22g)

134-G. Production Machining Titanium. W. L. Carr. *Western Machinery and Steel World,* v. 48, Mar. 1957, p. 94-95. (CMA)

Rigid set-ups and sharp tools make machining titanium for the F-102 easy. Tungsten carbides are used since the titanium carbide tools tend to fuse to the work. Procedures for a titanium support to an engine mount are described. (G17; Ti)

135-G. (Italian.) **Review of Principal Characteristics of Spheroidal Cast Iron. Part II.** Domenico Mensa and Mario Noris. *Ingegneria Meccanica,* v. 5, July 1956, p. 25-34.

Further data on physical and mechanical characteristics. Data on machinability on lathes showing that with certain types of this material it is possible appreciably to reduce machining times. 22 ref. (G17k, Q general; CI-r)

136-G. (Italian.) **The Phenomenon of Flow Lines or Luder's Lines on Stamped Parts.** Raoul Secco. *Ingegneria Meccanica,* v. 5, July 1956, p. 35-38.

Examination of aspects such lines assume on stamped parts, difficulties they cause, reasons for their appearance. Relationship between appearance of lines and behavior of yield phase in stress-strain diagram. Preventive measures and efficacy of a skin pass or temper rolling. Importance of storage temperature in tendency of material to form Luder's lines. (G3, 9-21)

137-G. (Italian.) **Productivity of Tools, Machinability of Metals in Operations Requiring Chip Removal.** Tomasso Bruzzone. *Ingegneria Meccanica,* v. 5, Mar. 1956, p. 46-48.

Criteria to be borne in mind in determining proper tests. (G17k, 1-4)

138-G. (Italian.) **Machining Gears With "Generators".** Luigi Gazzaniga. *Macchine,* v. 12, Jan. 1957, p. 11-15.

New machine tools of English manufacture permit "generation" of

most varied shapes and tooth depths in less time than on conventional machines. "Generator" tool in high speed steel produces medium and fine finishes. (G17g, 1-2; TS-m)

139-G. (Italian.) High Speed Steels and Nondeforming Sulphurized Steels. R. C. Auer. *Macchine,* v. 12, Jan. 1957, p. 27-30.

Sulphurization improves machinability as well as cutting potential of certain conventional high speed steels. Work of Latrobe Steel Co. in this field.
(G17k; TS-h, TS-m, AD-q)

140-G. New Development in Impact Extrusion Field Extends Process Control. Marvin M. Goldstein. *Industrial Heating,* v. 24, Jan. 1957, p. 75-76, 82.

Machine produces slugs for impact extrusion by casting directly from molten aluminum. (G5, 1-2; Al)

141-G. Performance of Ceramic Tools. A. O. Schmidt, W. I. Phillips, C. F. Wilson and I. Ham. *Machinery,* v. 90, Mar. 15, 1957, p. 577-583.

Preliminary tool life and wear tests were made with workpieces of AISI 1045 and 4150 steels and B-45 cast iron. Performance of ceramic tools was compared with carbides, nature of wear process for ceramic tools studied.
(G17, Q9, S21; SGA-j, NM-f)

142-G. The Phenomenon of Cutting. O. Kienzle. *Microtecnic,* v. 10, 1956, p. 253-256.

Investigation of the following questions: (1) What happens when metals are cut? (2) What influences the quality of the cut surface? (3) What produces a burr? (4) How is the wear of the cutting tool affected? (G17, 1-4)

143-G. Ultrasonic Grinding. Milton C. Shaw. *Microtecnic,* v. 10, 1956, p. 257-265.

Current commercial ultrasonic grinding apparatus is described and representative operating characteristics considered. Several possible sources of cutting action are presented and the equations describing these actions discussed. It is found that the primary action responsible for material removed in ultrasonic grinding is that of abrasive particles being hammered into the work surface in a manner that is somewhat similar to the comminution action found in a ball milling operation although subject to a much higher rate of metal removal and a finer degree of control. 7 ref. (G18, 1-24)

144-G. Study of the Influence of the Addition of Sulphur on the Machinability of a Medium-Carbon Steel. Paul Bastien and Michel Weisz. *Microtecnic,* v. 10, 1956, p. 723-728.

Figures given on the influence of sulphur on the coefficient of friction between chip and tool as a function of feed, and cutting temperature as a function of cutting speed. (G17k; CN, S)

145-G. Spinning Aluminum. (Pt. 2) J. W. Lengbridge. *Modern Metals,* v. 13, Mar. 1957, p. 40-46.

Briefly covers displacement spinning, effect of contour, calculation of blank size, spinning speeds and lubricants, equipment tool and chuck design and internal roll spinning. (G13, 1-2; Al)

146-G. (French.) The Pressing of Metals and Light Alloys. Robert Chopin. *Revue de l'Aluminium,* no. 236, Oct. 1956, p. 943-948.

Evolution of deep drawing; Marform, Hydroforming and Wheelon processes; pressing of conical parts with the method of swaging, pressing with a unique die, pressure on a semispherical part, forming by inside out pressing; spinning and modern flow-spinning machines; possibilities offered by impact extrusion. (G1, 1-2)

147-G. (Japanese.) Cutting Temperature. Keiji Okushima and Ryuji Shimoda. *Japan Society of Mechanical Engineers, Transactions,* v. 23, Feb. 1957, p. 73-77.

Deals with the possibility of application of the theoretical equation by Loewen & Shaw (1954) to orthogonal cutting with discontinuous chip under the conditions contrary to the assumptions in case of the theoretical analysis; rate at which the cutting heat diffuses to chip, tool and workpiece. (G17, 1-4)

148-G. (Pamphlet—French.) Practical Information on the Machining of Aluminum and Its Alloys. 64 p. 1956. L'Aluminium Francais, 23, Rue Blazac, Paris 8, France.

Mechanical characteristics of aluminum and its alloys; principal factors in their machining such as the influence of lubricants and nature of tools; problems involved; conditions of working and methods employed in turning, cutting, planing, milling, drilling, tapping, threading and sawing of aluminum and its alloys; finishing processes.
(G17; Al)

149-G. (Pamphlet—French.) Practical Information on the Manual Forming of Aluminum and Its Alloys. 40 p. 1956. L'Aluminium Francais, 23, Rue Balzac, Paris 8, France.

Concise account of the hand working of sheets, tubes and sections of aluminum and its alloys. Details relating to storage, methods of cutting, bending, hammering, flaring, stretching and plate bending; forming tools; cold working and hot working; general precautions to be taken; faults to be avoided and appropriate techniques.
(G general; Al)

H Powder Metallurgy

24-H. Dispersed Hard Particle Strengthening of Metals. Nicholas J. Grant and Oliver Preston. *Journal of Metals,* v. 9; *AIME Transactions,* v. 209, Mar. 1957, p. 349-356.

Review of increased strength and stability at high temperatures of metals such as aluminum, molybdenum, copper, nickel and magnesium, upon dispersion of hard finely divided particles of aluminum oxide or other materials; mechanical mixing and sintering; internal oxidation and other methods of achieving hard particle distribution; theoretical aspects of hardening and strengthening mechanism. 37 ref. (H16d, Q27a, Q29n)

25-H. Metallic Filters by Powder Metallurgy. John Haertlein. *Journal of Metals,* v. 9, Mar. 1957, p. 326-330.

Data on sintered bronze filters; their calculated pore size; efficiency compared to paper filters; influence of sintering time and temperature on shrinkage, effect of shrinkage on permeability, strength and pressure drop characteristics; uses of stainless steel and metallic fiber filters. (H general, X21, 17-7; Cu-s, SS)

26-H. High Strength Structural Parts by Powder Metallurgy—Theory. Henry H. Hausner. *Journal of Metals,* v. 9, Mar. 1957, p. 331-333.

Crystal lattice defects, their orientation and relationship to strength in powder metallurgy; effect of compacting temperature and time on physical properties; density-strength relationship. (H11, M26)

27-H. High Strength Structural Parts by Powder Metallurgy—Techniques. George Stern. *Journal of Metals,* v. 9, Mar. 1957, p. 334-335.

Sintering, hot pressing, infiltration and vacuum sintering techniques used for producing high strength parts. (H14h, H15, H16e)

28-H. High Strength Structural Parts by Powder Metallurgy—Applications. J. M. Copeland. *Journal of Metals,* v. 9, Mar. 1957, p. 336-339.

Importance of control of material, die design and fabricating variables in production of high-strength parts. (H general; SGB-a)

29-H. Metal and Self-Bonded Silicon Carbide. R. E. Wilson, et al. U.S. Air Force. Wright Air Development Center. Technical Report 54-38, Jan. 1956. *U.S. Office of Technical Services,* PB 121353, 33 p. (CMA)

A study of the hot pressing of molybdenum-silicon carbide compositions shows that a bond of Mo_5Si_3 results. This was synthesized and used as the aggregate in a nickel-bonded cermet. Three compositions were evaluated as rocket nozzle materials. (H14h, Si, 6-19)

30-H. Development of Titanium Powder Production. Final Report. A. J. Hatch, E. P. Weber and A. D. Schwope. U.S. Watertown Arsenal Laboratory. Report 401/120-24, Sept. 1955. *U.S. Office of Technical Services,* PB 121766, 44 p. (CMA)

Strengths from powder metallurgical Ti-6 Al-4V have been obtained which are comparable to the arc melted and worked alloy; hot pressing was used. Ball milling in inert atmosphere was used to prepare fine master alloys, which may then be hydrided for fast commutation.
(H10, H14h; Ti)

J Heat Treatment

70-J. Effect of Annealing in Various Gases on the Bulk Lifetime of Germanium. Kurt Weiser. *Journal of Applied Physics,* v. 28, Feb. 1957, p. 271-272.

High-resistivity germanium crystals were annealed at 500° C. in various gases. For an oxygen atmosphere with a trace of water vapor present, the bulk lifetime more than doubled, then decreased to below the initial value. (J23, J2k; Ge)

71-J. Slack Quenching of Steels. D. J. Blickwede and R. C. Hess. *Metal Progress,* v. 71, Mar. 1957, p. 97-103.

Quenching diagrams are presented for several common engineering alloy steels which enable the metallurgist to predict the course of transformation and the eventual microstructures and hardnesses of various size parts quenched either in oil or water. (J26n, N8p; ST)

72-J. Applications of Furnace Atmospheres. Clarence E. Peck. *Met-*

al Progress, v. 71, Mar. 1957, p. 104-112.

Prepared atmospheres are specified for bright annealing, bright hardening and for carburizing or carbonitriding of all varieties of plain and alloy steels, and suggestions given (devised from experience) as to the atmospheres conventionally used, their dew points and their carbon "potentials".
(J2k; CN, AY, TS, SS)

73-J. Vacuum Heat Treat Furnace Makes Titanium Parts Ductile. *Modern Metals,* v. 13, Mar. 1957, p. 76. (CMA)

Valuable hydrogen embrittled scrap has been salvaged by vacuum heat treating in a furnace designed by the Pacific Scientific Co. The furnace has been operated above 2000° F. and at pressures as low as 0.2μ. The components and the typical out-gassing cycle are described; a 6-hr. minimum has been established for sheet materials. Tear and notch tensile properties of titanium sheet are increased fourfold. Fabricators of A-286 alloy say that formability improves with solution heat treating.
(J27a, W27, 1-23, Q23p; Ti)

74-J. Induction Heating for the Interstage Annealing of Components on High-Speed Press Lines. K. A. Zandstra. *Sheet Metal Industries,* v. 34, Mar. 1957, p. 177-188.

Types of heating coils and supports. Work handling equipment for various types of coils. Cups drawn of rimming steel annealed at 600 or 900° C. in less than 2 min. Advantages include less danger of grain growth, small amount of scaling, high over-all economy and flexibility. (J23, J2g, 1-2; ST-d)

75-J. Surface Hardening of Titanium With Metalloid Elements. R. W. Hanzel and V. Pulsifer. U.S. Watertown Arsenal Laboratory. Report 401/84-25, May 1953. *U.S. Office of Technical Services,* PB 111821, 151 p. (CMA)

Surface hardening processes for titanium were studied, including those based on the hardening effects of nitrogen and oxygen, carburizing and hydrogen addition. Data for treating titanium with molten borax, fused salt baths and dissociated ammonia. (J27, J28, 2-10; Ti)

76-J. (Spanish.) **Experimental Verification of Lamont Curves on a 0.97% C, 1.44% Cr Steel.** Mario Pujol Roig. From "Papers Presented at 28th International Congress of Industrial Chemistry", 1956, 9 p.

Tests carried out to determine whether Lamont curves are equally applicable to this type of steel as to steels of up to 0.6% carbon content and low-alloy steels. Author concludes that only approximate values can be obtained. Study also shows why, in this type of steel, Jominy curve cannot be calculated on the basis of chemical composition and grain size. 14 ref.
(J5; AY, Cr)

77-J. Rockets for Steel Hardening. James A. Browning. *Welding Journal,* v. 36, Mar. 1957, p. 225-229.

Small rockets fueled by oxygen and propane have been investigated for the flame hardening of steel. The extremely fast heating rates followed by a water quench produce hardness values higher than those obtained by more conventional heating techniques. (J2h, 1-2; ST)

78-J. Some Thoughts on Spring Heat-Treatment and Finishing. E. Mitchell. *Wire Production,* v. 6, Jan. 1957, p. 5-13.

Hardening, tempering, austempering and finishing discussed.
(J26, J29; T7c)

79-J. (French.) **Case-Hardened Steels.** J. Marcovici and P. Tordjmann. *Métallurgie et la Construction Mécanique,* v. 89, Feb. 1957, p. 117-121.

Practical notes on case hardening; depth of case hardened layer, types of case hardening, carbon content of case hardened layer; grinding after case hardening and precautions to be taken; tempering of case hardened workpieces; remarks on the transformation range. (Concluded.) (J28; ST)

80-J. (Italian.) **Radiofrequency Electronic Induction Generators for Heat Treatment. Constructional and Operational Factors, Auxiliary Mechanical Equipment.** Antonio Tescari. *Ingegneria Meccanica,* v. 5, Mar. 1956, p. 17-29.

Examination of surroundings of proposed installation; practical considerations when equipment is to be handled by personnel without special training in electronics; construction specifications; mechanical accessories required to make installation technically acceptable and economically profitable. 15 ref.
(J2g, 1-2)

81-J. (Italian.) **Economic Aspects of Heat Treatment of Materials That Are Good Conductors of Electricity by Means of Radio Frequency Generators.** Giancarlo Giacometti. *Ingegneria Meccanica,* v. 5, Mar. 1956, p. 31-34.

Advantages of use of radio frequency generators for heat treatment of metal and metal alloys; operating frequency and power requirements and cost. (J2g, 1-2, 17-3)

82-J. (Spanish.) **Deformation Due to Hardening in 12% Cr, 2% C Ledeburitic Steel.** Francisco Joanxich Ayma. From "Papers Presented at 3rd General Assembly of the Iron and Steel Institute". 1956. 11 p.

Influence of carbides on deformation. Three specimens of toolsteel studied after hardening and tempering at temperatures ranging from 930 to 1010° C. and 200 to 500° C. for respective operations; 1010° and 500° produced high degrees of hardness that supposedly would be improved by increasing tempering temperature to a point between 500 and 600° C., while at the same time keeping deformation to an acceptable minimum. 10 ref.
(J29, 9-24; TS)

83-J. Annealing and Hardening Copper Coils. Albert Romeo. *Industrial Gas,* v. 35, Mar. 1957, p. 14-15.

Less handling is required, quality is better controlled, and production is increased when copper alloy coils are treated in pit-type furnace.
(J23, W27; Cu, 4-11)

84-J. Basic Furnace Atmospheres and Composition Effects. C. H. Vaughan. *Industrial Heating,* v. 24, Feb. 1957, p. 248-258, 424.

Basic types of furnace atmospheres are exothermically produced combustion gas, endothermically produced combustion gas, nitrogen, dissociated ammonia, hydrogen, argon and helium. Their production, variations, compositions and influence on metals being treated.
(J2k, B25; RM-g)

85-J. High Quality Gears and Assembly Parts Require Precise Heat Treating. John T. Mitchell and Russell Buyea. *Industrial Heating,* v. 24, Feb. 1957, p. 260-268, 274.

Continuous and vast equipment and processes for normalizing and carburizing SAE 8125 steel gears and shafts. Parts made from SAE 1030 and 1035 steel cyanided.
(J24, J28g, J28j, 1-2; AY, CN)

86-J. Selection and Application of Furnace Atmospheres for Quality Control. O. E. Cullen. *Industrial Heating,* v. 24, Mar. 1957, p. 465-474.

Atmosphere composition for carburizing, carbonitriding and recarburizing; studies of atmosphere composition emphasizes need for careful measurements and control of dew point and other minor as well as major constituents. (J2k; RM-g)

87-J. Steam Atmosphere Heat Treating Promotes Special Metal Characteristics. F. L. Spangler. *Industrial Heating,* v. 24, Mar. 1957, p. 478-488.

Equipment, process and applications to both ferrous and nonferrous parts. Tough oxide film gives advantages such as superior wear resistance, better machinability, greater corrosion resistance and clean parts for use of subsequent coating processes. (J2k, RM-g32)

88-J. Symposium on Continuous Annealing of Steel Strip. Papers Presented by Horace Drever, C. E. Peck, H. W. Lynn and E. B. Fitzgerald. *Iron and Steel Engineer,* v. 34, Feb. 1957, p. 69-94.

History; advantages of continuous versus batch annealing; heating and cooling cycles; furnaces and needed improvements; mechanical equipment; electrical drives.
(J23, 1-11, 1-2; ST)

Assembling and Joining

143-K. Resistance Welding Techniques. C. A. Burton. *Electrical Review,* v. 160, Feb. 15, 1957, p. 273-278.

Advantages and applications to the aircraft, auto and railway industries of flash-butt, spot, stitch and seam welding. (K3)

144-K. Electricity Plays Many Roles in Welding. A. C. Ward. *Iron Age,* v. 179, Mar. 14, 1957, p. 140-142.

Relation of welding voltage, average time and circuit direction on weld heat. Influence of electrode type and arc length. (K1, 16-11, W29)

145-K. High Temperature Brazing Proves O.K. for Jet Engines. John V. Long, George D. Cremer and Richard S. Mueller. *SAE Journal,* Mar. 1957, p. 43-49.

Some examples of brazing technique for producing high-temperature brazed assemblies of turbojet-engine components, such as anti-icing panels, compressor casings, compressor stator blades, heat exchangers, turbine rub rings, filled honeycomb cores, and turbine nozzles. (K8, 2-12, T24b)

146-K. Tig Welded Zircaloy-2 Atomic Fuel Tank. *Welding Engineer,* v. 42, April 1957, p. 76. (CMA)

The tungsten-inert gas welding process was used by Newport News Shipbuilding and Drydock Co. to fabricate a nuclear fuel tank of Zircaloy-2. Conical and spherical sections and forged pipes were welded together. Joints were welded

automatically and insert wire and interior perforated disk cross sections were manually welded. In all cases the Tig torch was stationary and the workpiece moved. (K1d, 1-2, T11; Zr)

147-K. Effect of Irradiation on Weldability of ASTM A212, Grade B. W. R. Hutchinson. *Welding Journal,* v. 36, Mar. 1957, p. 105s-112s.

Weldability tests were conducted on ASTM A212 Grade B pressure plate material in both the irradiated and unirradiated conditions. Results indicate that prior irradiation by an integrated thermal flux of 10^{16} nvt. does not have much effect on the weldability of pressure vessel material. 25 ref. (K9s, 2-17, T26q; AY)

148-K. Alloys for Brazing Thin Sections of Stainless Steel. A. S. McDonald. *Welding Journal,* v. 36, Mar. 1957, p. 131s-140s.

Suitability of the alloys 72Ag-28Cu, 72Ag-28Cu + 0.5Li, 85Ag-15Mn, 85Ag-15Mn + 0.5Li and 68Mn-32Ni are discussed as candidates for brazing thin sections of stainless steel. The results of wetting tests on Types 304, 321 and 17-7 PH stainless steel in hydrogen atmosphere at various dew points and temperatures are presented. 5 ref.
(K8, P13; SS, SGA-f)

149-K. Properties and Weldability of High-Strength Pressure-Vessel Steels in Heavy Sections. J. H. Gross and R. D. Stout. *Welding Journal,* v. 36, Mar. 1957, p. 157s-167s.

Study of the effects of plate thickness and of position in the plate on the mechanical properties and weldability of these materials.
(K9s, Q general, T26q; ST, 4-3)

150-K. Inert-Gas Tungsten-Arc Butt Welding of Zircaloy-2 Tubes. J. W. Lingafelter. *Welding Journal,* v. 36, Mar. 1957, p. 230-235.

Techniques employed for welding internally ribbed Zircaloy tubes; analysis of mechanical, metallurgical and corrosion data obtained on duplicate test samples to determine weld properties. (K1d, K9r; Zr, 4-10)

151-K. Joint Design for Making Root-Pass Welds Without Filler Metal. L. C. Lemon and W. R. Smith. *Welding Journal,* v. 36, Mar. 1957, p. 240-242.

Describes a new, practical joint design and welding technique for making sound root-pass welds without the use of backing rings in stainless steel, killed steel and aluminum piping.
(K1, 17-1; SS, ST-c, Al, 4-10)

152-K. Peripheral Welding of Internally-Clad Steel for Nuclear Reactor Application. W. Leonard and J. C. Thompson, Jr. *Welding Journal,* v. 36, Mar. 1957, p. 243-251.

Special procedures have been developed for welding a spherical pressure-vessel shell made of carbon steel plate clad with Type 347 stainless steel. 3 ref.
(K1d, W11, 17-7; CN, *SS,* 8-16)

153-K. (French.) **Machine Welding of Special Steels and Light Alloys in an Argon Atmosphere.** R. Arnaud. *Metaux-Corrosion-Industries,* v. 32, Jan. 1957, p. 38-45.

Describes a machine capable of automatic argon welding permitting a precise control of the essential parameters of the welding process.
(K1d, 1-2)

154-K. (Spanish.) **Welding.** *Ciencia y Tecnica de la Soldadura,* v. 6, Nov.-Dec. 1956, 2 p.

Thermo-electronic emission. (To be continued.) (K1)

155-K. (Spanish.) **Technique and Applications of Wedge Welding.** Wilhelm Hofmann. *Ciencia y Tecnica de la Soldadura,* v. 6, Nov.-Dec. 1956, 4 p.

Copper and aluminum profiles are welded by giving the copper end a cone or wedge shape and introducing the shaped end into aluminum by means of pressure. Best welding temperature is between 548° C. and melting point of aluminum. A eutectic fluid which eliminates surface oxides is formed in the contact zone by diffusion. Steel and aluminum can be similarly joined by protecting the cone or wedge against oxidation with a zinc or silver coating. 6 ref.
(K5k; Cu, Al, ST)

156-K. (Spanish.) **Economic Aspects of Submerged Arc Welding in Naval Construction.** Vincenzo di Bella. *Ciencia y Tecnica de la Soldadura,* v. 6, Nov.-Dec. 1956, 12 p.

Summary of development and use of automatic welding in naval construction; examination of problems encountered, new work cycles, advantages and disadvantages of latter. Economic comparison of a job carried out by conventional methods and another done with modern automatic welding machines and oxy-acetylene cutting equipment. Shows importance of non-use index of machines and influence on total cost. (K1e, T22)

157-K. (Spanish.) **On the Use of Contactors and Electronic Control Equipment in Modern Resistance Welding Machines.** A. Plaza Alonso. *Ciencia y Tecnica de la Soldadura,* v. 6, Nov.-Dec. 1956, 14 p.

After brief exposition of general problems of control with reference to resistance welding machines, study is made of mercury vapor rectifier tubes, with special attention to characteristics, assembly and maintenance of ignitron-type electronic counters, choice of welding cycles and electronic control devices. 14 ref. (K3, 1-2)

158-K. Welding Repair of a Giant Turbine Runner. (Pt. 2). F. P. Y. Arseneault. *Canadian Metals,* v. 20, Mar. 1957, p. 46-51.

Records gouging and welding conditions used in the removal of segment of trailing edge of runner and repair by attachment of stainless steel strips. Pitting repaired by build-up of welded metal.
(K general, W11, 17-7, 18-22; SS)

159-K. Investigation and Development of High-Temperature Structural Adhesives. A. S. Kidwell and K. L. McHugh. Connecticut Hard Rubber Co. (Wright Air Development Center). *U.S. Office of Technical Services,* PB 121657, Sept. 1956, 75 p.

Various epoxy-modified silicone resin adhesives investigated as bonding materials for aluminum and stainless steel and for their ability to maintain strength at 500 and even 700° C. required for improved jet engines. (K12; NM-d34, Al, SS)

160-K. Ductility Related to Service Performance of Heavy-Wall Austenitic Pipe Welds. Henry M. Soldan and Charles R. Mayne. *Welding Journal,* v. 36, Mar. 1957, p. 141s-147s.

Correlation of the results of hot ductility tests with the fabrication and service performance of welds in heavy-wall austenitic-steel piping in high-temperature central station service. 14 ref.
(Q23p, 2-12; SS, 7-1, 9-22)

161-K. (French.) **Cost Study of Argon Shield Arc Welding of Aluminum and Its Alloys.** J. G. Young. *Revue de l'Aluminium,* no. 236, Oct. 1956, p. 953-962.

Method for calculating cost of argon shielded arc welding of aluminum and its alloys, both with refractory and consumable electrodes. In most applications arc welding under argon shield is faster and cheaper than riveting. (K1d, 17-3)

162-K. (German.) **New Working Devices Facilitate Contacting of Relay Springs.** Joseph Knoll. *Werkstatt und Betrieb,* v. 90, Feb. 1957, p. 147-148.

Mounting of rare metal contacts to relay springs by automatic riveting press with electronic time limiter and a vibration-promoting apparatus for arranging and feeding of rivets.
(K13n; EG-b, SGA-r)

163-K. (Pamphlet—French.) **Practical Information on Argon Shielded Arc Welding of Aluminum and Its Alloys.** 54 p. 1956. L'Aluminium Francais, 23, Rue Balzac, Paris 8, France.

Survey of the two principal methods of argon shielded arc welding—with a refractory electrode and with a consumable electrode. Information concerning current selection, welding equipment such as types of torches, apparatus to supply water, electric power and argon; electrodes; protective clothing and masks; preparation of surfaces to be welded; methods and techniques of welding.
(K1d, 1-2; Al)

164-K. (Pamphlet—French.) **Practical Information on Braze Welding and Brazing of Aluminum and Its Alloys.** 23 p. 1955. L'Aluminium Francais, 23, Rue Balzac, Paris 8, France.

Principle underlying braze welding and brazing; types of filler materials used; techniques employed; specification of conditions producing optimum results. (K8; Al)

165-K. (Pamphlet—French.) **Practical Information on the Oxy-Acetylene Welding of Aluminum and Its Alloys.** 48 p. 1956. L'Aluminium Francais, 23, Rue Balzac, Paris 8, France.

Equipment used in welding—torches, pressure regulators; preparation of surfaces (degreasing and pickling); nature and utilization of flux; methods of welding; including concise information on speed and consumption of gas; positioning; specifications of procedure for special alloys; terminal operations such as washing, cleaning and polishing.
(K2h, 1-2; Al)

166-K. (Pamphlet—French.) **Practical Information on the Resistance Welding of Aluminum and Its Alloys.** 35 p. 1956. L'Aluminium Francais, 23, Rue Balzac, Paris 8, France.

Survey of resistance welding from the point of view of preparation of surfaces for welding—degreasing, scouring, pickling; types of welding machines; electrodes; current regulation, pressure regulation and timing; correlation of common defects with probable causes; methods of detecting flaws and quality control. (K3, 1-2, S13; Al)

167-K. (Book.) **Standard Specifications for Welded Highway and Railway Bridges.** 5th Ed. 86 p., 1956.

American Welding Society, D2.0-56, 33 West 39th St., New York 18, N. Y. $1.50.

On the basis of extended experience, existing requirements have been revised and clarified so that specifications constitute a more workable set of requirements for the effective use of welding in the construction of bridges and other structures subject to dynamic loadings. Important additions are provisions for use of a special welded bridge steel and submerged arc welding requirements.
(K general, S22, T26p; ST)

Cleaning, Coating and Finishing

163-L. Characteristics of Refractory Oxide Coating Produced by Flame-Spraying. N. N. Ault. *American Ceramic Society Journal,* v. 40, Mar. 1, 1957, p. 69-74. (CMA)

Application of refractory oxides by flame-spraying rods of these materials. Zirconia, stabilized with calcium oxide, is coated on a base with only the cubic form present. The bulk density can be varied more easily than with alumina coatings. In a thermal expansion test the coat reverted to a mixture of the cubic and monoclinic forms. Zircon dissociates when flame sprayed, and X-ray diffraction of the coat reveals only cubic ZrO_2. The coating has a glassy nature and inverts to the monoclinic form on thermal treatment. (L27, 1-2; *Zr*)

164-L. Flame Spraying Spins Protective Coating for Missiles. *Jet Propulsion,* v. 27, Mar. 1957, p. 306-311.

Flame spraying; processes and properties of coatings. 11 ref.
(L27; T2)

165-L. Diffusion Coating With Silicon. N. S. Gorbunov and A. S. Akopdzhanyan. *Journal of Applied Chemistry of the USSR,* v. 29, May 1956, p. 713-716. (Translated by Consultants Bureau, Inc., 227 W. 17th St., New York 11, N.Y.).

An advantage of the proposed method for diffusion coating is filling of the reaction space of furnace with chlorine at room temperature. The thickness of the silicon layer depends on the temperature and duration of treatment and on the carbon content in the base metal. 12 ref. (L15; *Si*)

166-L. Investigation of the Causes of Foaming of Pickling Solutions. V. A. Kuznetsov and I. G. Chufarova. *Journal of Applied Chemistry of the USSR,* v. 29, May 1956, p. 749-752. (Translated by Consultants Bureau, 227 W. 17th St., New York 11, N.Y.).

Stability of foam formed by industrial pickling baths and by artificial solutions. The experimental results show that the foam formed in pickling solution is stabilized by colloidally dispersed silicon dioxide (SiO_2) which accumulates in the solutions during their use. (L12g)

167-L. The Norton Roxide Coating Process for High-Temperature Operation. *Machinery (London),* v. 90, Mar. 8, 1957, p. 525-527. (CMA)

Protective coats of refractory oxides are applied by spraying onto the cold metal base. Zirconia, melting at 4500° F., may be applied to low-melting metals like aluminum and magnesium without harming them. The coating materials are alumina, zirconia or a zirconia-silica mixture and are used in rod form. An oxy-acetylene flame spray gun is used. Applications are described and shown. (L27, 1-2; Al, Mg, *Zr*)

168-L. Electrolytic Polishing. J. Bergere and R. Mondon. *Metal Industry,* v. 90, Feb. 1957, p. 127-129.

Effects of surface finish obtained by electrolytic or mechanical polishing on fatigue strength and corrosion resistance. Types of tanks and other equipment, solutions for different groups of alloys, chief applications of electropolishing.
(L13p, Q7a, R general)

169-L. Protection of Steel Surfaces. The Chromizing Process of Metal-Gas Co. Ltd. *Metal Treatment and Drop Forging,* v. 24, Feb. 1957, p. 65-68.

Advantages and applications of patented British chromizing process in which high reactive chromous chloride is brought in contact with steel surface at temperatures of the order of 1000° C. (L15; ST, *Cr*)

170-L. Painting of Galvanized Steel. H. W. Chatfield. *Paint, Oil and Colour Journal,* v. 131, Feb. 22, 1957, p. 430-434.

Calcium plumbate with water-ground mica added shows advantages over red lead. Baked primers improve adhesion. Results of natural weathering tests are given.
(L26n, R3; ST, 8-15, NM-g30)

171-L. Brushes Solve Finishing Problems. R. C. Sasena. *Steel,* v. 140, Mar. 18, 1957, p. 144-146.

Power brushes are used to deburr and finish automatic transmission parts including steel gears and shafts, clutch housings, etc.
(L10e; ST)

172-L. Siliconizing of Metals in Liquid NaK. E. S. Fisher, R. A. Noland and C. Marzano. Paper from "Metallurgical Information Meeting, Ames Laboratory", May 1956, *U.S. Atomic Energy Commission,* TID-7526 (Pt. 1), Feb. 1957, p. 268-281.

Surface diffusion layers consisting of base metal silicides have been produced on uranium, molybdenum and some steels by immersing the metal in liquid sodium-potassium alloy containing dissolved silicon. This method of siliconizing is advantageous in that the coatings can be produced at relatively low temperature, and oxidation of the surface prior to the formation of the silicides can be minimized in the sodium-potassium medium. Consequently, it may be a favorable means for producing corrosion resistant surfaces on some reactive metals.
(L15; U, Mo, ST, *Si*)

173-L. (French.) **Stains on Electrolytic Deposits: Origin and Remedies.** J. Liger. *Galvano,* no. 241, Feb. 1957, p. 37-39.

Investigation into the origin of small white stains appearing on recently prepared electrolytic deposits. Causes of this phenomenon; suggests that porosity of the metal is the principal factor. Appropriate remedies. (L17c, 9-21)

174-L. (French.) **Industrial Methods of Chemical Brightening of Aluminum.** A. W. Brace. *Galvano,* no. 241, Feb. 1957, p. 40-50.

Two principal types of finishing by means of chemical baths, one with a phosphoric acid bath and the other containing nitric acid and ammonium difluoride; equipment employed; anodizing techniques.
(L14, 1-2, L19; Al)

175-L. (French.) **Pickling Before Galvanizing.** A. Herz. *Métallurgie et la Construction Mécanique,* v. 89, Feb. 1957, p. 125-127.

Form in which oxides appear, conditions under which they are formed and means of attacking them. Studies comparative advantages and drawbacks of sulphuric acid and hydrochloric acid. The main drawback of the former lies in the difficulty of getting rid of the sulphates produced. Inhibitors slow down the attack by acids but their choice is difficult. (L12g, L16; *Zn*)

176-L. (French.) **Chemical Oxidation of Light Metals by Alodine 100.** Jean-Jacques Meynis de Paulin. *Revue de l'Aluminium,* no. 240, Feb. 1957, p. 187-195.

The Alodine 100 chemical oxidation bath, composed mainly of phosphoric acid, chromic acid and fluorine, provides a blue-green film of amorphous double phosphate of chromium and aluminum. Reviews the grading and operation of the bath; the properties of the light metal surfaces thus treated; adhesion of the film of Alodine 100; behavior of the main classes of paint. (L14a; Al)

177-L. (German.) **Defective Spots in Anodically Oxidized and Dyed Sheet and Means for Their Avoidance.** F. E. Farrell. *Aluminium,* v. 33, Feb. 1957, p. 91-94.

Conditions under which circular bright and dark spots appeared in $AlMg_3$ sheet studied and methods to prevent them described.
(L19; Al, 9-21, 4-3)

178-L. (German.) **Porcelain Enameled Aluminium.** E. A. Ferrel. *Aluminium,* v. 33, Feb. 1957, p. 107-114.

Physical and chemical properties of enameled aluminum, comparison to steel, manufacture and storage, applications in the field of shipbuilding and architecture.
(L27, T22, T26; Al)

179-L. (German.) **New Structural Components Through Roll-Cladding.** H. Nielsen and H. Supplus. *Aluminium,* v. 33, Feb. 1957, p. 115-119.

Describes the American "Roll-Bond" or "Tube-in-Strip" process for heat exchanger elements and tube in strip form, and the German "Evidal System" for manufacture of evaporator components for refrigerators. (L22; 4-10)

180-L. (German.) **Sprayed Molybdenum Coatings.** R. Machenschalk. *Planseeberichte fuer Pulvermetallurgie,* v. 4, Dec. 1956, p. 80-84. (CMA)

Advantages of sprayed molybdenum coatings are their very high melting point (2620° C.) and their hardness (350-620 kg. per sq. mm. Vickers hardness); they are, therefore, recommended as excellent coverings for machine parts, such as crankshafts, rollers, etc. However, these coatings are porous and their chemical resistance is low; this prevents their use in anticorrosion protection of surfaces. 8 ref. (L23, *Mo*)

181-L. (Italian.) **Theory of Spray Metallizing.** Gian Giacomo Coccia. *Ingegneria Meccanica,* v. 5, June 1956, p. 23-28.

Theory of process, plus considerations on formation and physical properties of coating applied. (L23)

182-L. (Swedish.) **"Mollerization"—a New Method for Aluminum Coating Steel.** H. E. Linden. *Industritidningen Norden*, v. 84, no. 22, Oct. 31, 1956, p. 300-301, 308.

New method employing low voltage, direct current salt bath containing barium chloride, sodium chloride and cryolite. The salt cover protects the aluminum from oxidation. (L29; ST, *Al*)

183-L. (Swedish.) **Hydrogen Embrittlement in Steel in the Process of Electroplating.** Uno Trägardh. *Teknisk Tidskrift*, v. 86, Dec. 4, 1956, p. 1051-1057.

Cathodic removal of grease; pickling; and electrolytic precipitation of zinc, cadmium, copper, tin and silver. Special notice given to the influence of hydrogen absorption on the steel. (L17, L12, Q26s; ST, *H*)

184-L. Chemical Brightening of Aluminium. A. W. Brace. *Metal Industry*, v. 90, Feb. 23, 1957, p. 147-151 and 153.

Basic principles, composition and operations of brightening baths, equipment, anodizing techniques, testing method for film thickness, brightness, corrosion and abrasion resistance. 17 ref. (L19; Al)

185-L. Degreasing (Pt. 1). J. E. Entwistle. *Metal Industry*, v. 90, Mar. 8, 1957, p. 189-191.

Enumeration of factors involved in selecting a cleaning process for any particular application and review of various materials which are commercially available, including alkaline cleaners, hydrocarbon solvents. (To be continued.) (L12)

186-L. Degreasing. (Pt. 2). J. E. Entwistle. *Metal Industry*, v. 90, Mar. 15, 1957, p. 212-214.

Enumeration and discussion of cleaning agents and methods including chlorinated hydrocarbons, acid cleaners and fused salt baths. (To be continued.) (L12)

187-L. Recent Developments in Aluminium Electrodeposition. R. J. Heritage and J. R. Balmer. *Product Finishing*, v. 10, Mar. 1957, p. 54-58.

Considers and compares Grignard electrolyte, fused quaternary ammonium salts, lithium hydride solutions and aluminum alkyl electrolyte for electroforming and for possible plating on copper, iron or steel. 16 ref. (L17a, L18; Cu, ST, Fe, *Al*)

188-L. An Iridium Plating Solution. P. J. Ovenden. *Product Finishing*, v. 10, Mar. 1957, p. 62.

Solution for electrodeposition of iridium on copper coated steel wire. (L17a; *Ir*, 4-11)

189-L. Testing and Examination of Electrodeposits. 1. Measurement of Local Thickness. R. Quarendon. *Product Finishing*, v. 10, Mar. 1957, p. 65-74, 130.

Methods for measuring local thickness including jet dropping and spot tests, microscopic examination, coulometric anodic solution and magnetic method; illustrates instruments used in testing. 22 ref. (L17c, 1-3)

190-L. Production of Bonderized Electro-Zinc Coated Steel Sheet. *Sheet Metal Industries*, v. 34, Mar. 1957, p. 165-172.

Description of plant and processing line. (L15, 1-2; ST, *Zn*)

191-L. (French.) **Chemical Nickel Plating by the Kanigen Process.** Grégoire Gutzeit. *Revue de l'Aluminium*, no. 235, Sept. 1956, p. 805-809.

Basic idea of this process is the oxide reduction of a nickel salt by sodium hypophosphite. With this catalytic reaction a secondary combination of a fraction of the nickel with phosphorus takes place. The alloys so formed can be submitted to heat treatments which change their structure. Provides very hard and protective coatings on aluminum pieces. (L28; Al, *Ni*)

192-L. (French.) **Deterioration of Aluminum Alloy Surfaces Treated by Bright Anodic Oxidation and Submitted to Heating.** Pierre Lelong and Jean Herenguel. *Revue de l'Aluminium*, no. 236, Oct. 1956, p. 923-930.

High-purity aluminum (99.99%) and in particular the high-purity alloy Brillalmag 1 containing 1% magnesium (A9-G1) are used, after bright anodic oxidation, to produce various types of reflectors. Following heating by focused infrared radiation attention has been drawn to cracks forming in the oxide film and peeling resulting from the action of heat. Suggests methods of avoiding these defects. 4 ref. (L19; Al, 9-21, 9-22)

193-L. (Spanish.) **Experiments in Hot Dip Aluminizing of Steel.** Justo Ferrer Flotats. From "Papers Presented at 28th International Congress of Industrial Chemistry", 1956, 5 p.

Molten bath immersion method used on cylindrical test pieces (104 x 70 mm.) of 99.5% pure commercial aluminum and 12% Si aluminum alloy. Silicon reduced thickness and hardness of aluminized coatings, while increasing adhesion. 11 ref. (L16; ST, *Al*)

194-L. (Book.) **Symposium on Properties, Tests, and Performance of Electrodeposited Metallic Coatings.** *American Society for Testing Materials.* Special Technical Publication, SPT 197, 1957, 129 p.

Corrosion behavior and protective value of copper-nickel-chromium and nickel-chromium coatings on steel; evaluation of methods available for measurement of surface luster of electroplated coatings; recommended practices for cleaning prior to electroplating; a comparison of the corrosion behavior and protective value of electrodeposited zinc and cadmium coatings on steel; evaluation of phosphate coatings over electrodeposited zinc.
(L17; ST, *Zn, Cd*, 8-12)

Metallography

Constitution and Primary Structures

126-M. Thermodynamic Investigation of Nonmetallic Inclusions in Steel—I. Behavior of Aluminum, Silicon and Iron Nitrides and Their Effect on Austenite Grain Size of Steel. Hiroshi Sawamura and Teshisoda Mori. *Kyoto University, Memoirs of the Faculty*, v. 18, Oct. 1956, p. 378-401.

Investigations of the change of content and the state of nonmetallic inclusions in steel which influence its mechanical properties, especially its austenite grain size. Only the indigenous inclusions were taken into consideration. 40 ref. (M27c, P12; Ay, 9-19)

127-M. Tabulation, Bibliography, and Structure of Binary Intermetallic Compounds. I. Compounds of Lithium, Sodium, Potassium, and Rubidium. S. G. Epstein, D. M. Bailey, R. L. Smythe, G. R. Kilp and J. F. Smith. Iowa State College. *U.S. Atomic Energy Commission*, ISC-795. Sept. 1, 1956, 31 p.

The material is separated into three sections. The first part consists of a tabulation and includes the crystal class, lattice parameters, and Strukturbericht structure symbol or space group symmetry if the data have been reported. The second part of the compilation is the list of references, and the third part is a summary of structure details. The structure details include the space group symmetry, the number of atoms per unit cell, the atomic coordinates, and a list of compounds assigned to the structure. (M26, M25m; Li, Na, K, Rb)

128-M. A Macroetch for Uranium. R. B. Russel. Paper from "Tenth Metallographic Group Meeting", Oct. 24, 1956. *U.S. Atomic Energy Commission*, TID-7523 (Pt. 1), Dec. 1956, p. 7-13.

The procedure is based on the fact that uranium dissolves rapidly in concentrated hydrochloric acid and that this acid corrodes uranium grains at very different rates which depend markedly on the kind of crystallographic face of the grain exposed to attack. By using such an acid, grains, and even twin bands within them, may be made clearly visible to the naked eye or with low magnifications. (M20q, M28g; U)

129-M. New Etching Methods for Thorium. David Peterson and Donald Westlake. Paper from "Tenth Metallographic Group Meeting", Oct. 24, 1955. *U.S. Atomic Energy Commission*, TID-7523 (Pt. 1), Dec. 1956, p. 15-21.

An etching procedure for thorium metal has not been completely developed. However, formic acid solutions of hydrogen chloride and hydrogen iodide seem to be very promising. The use of potentially explosive mixtures is avoided, obliteration of inclusions seems to be reduced, and extraneous pitting of the samples seems more easily controlled. (M20q; Th)

130-M. Inclusion Counting Methods for Uranium. C. L. Angerman, S. J. Broderich, R. F. Dickerson, A. E. Guay, L. A. Hartcorn and N. C. Kloepper. Paper from "Tenth Metallographic Group Meeting", Oct. 24, 1955. *U.S. Atomic Energy Commission*, TID-7523 (Pt. 1), Dec. 1956, p. 23-34.

Method for rating the inclusion content should provide information as to the identity and the concentration of the individual inclusions. With uranium, this is best accomplished by a micro method which (a) will give the identity, concentration, and length of the stringers of inclusions, and (b) will give the concentration of the other inclusions not aligned in stringers (i.e., background). Due to the large numbers of inclusions that are usually found in reactor grade uranium, this micro method would be laborious and time consuming. Therefore, a macro method would be useful as a relatively fast means of rating the total inclusion content of a sample neglecting the identification of the inclusions. (M27, 1-4; U, 9-19)

131-M. Metallographic Determination of Uranium-Niobium Phase Diagram up to 10% Niobium. A. E.

Dwight. Paper from "Tenth Metallographic Group Meeting", Oct. 24, 1955. *U.S. Atomic Energy Commission*, TID-7523 (Pt. 1), Dec. 1956, p. 37-47.

Metallographic examination has determined the eutectoid line and the lower boundaries of the gamma field but has not conclusively established the alpha to beta transformation. Present method is to bracket the boundary of a phase field within increasingly narrow limits of temperature, until eventually a ± 2° bracket is obtained. (M24b; U, Cb)

132-M. Metallography of the Epsilon Phase in the Uranium-Zirconium System. A. N. Holden. Paper from "Tenth Metallographic Group Meeting", Oct. 24, 1956. *U.S. Atomic Energy Commission*, TID-7523 (Pt. 1), Dec. 1956, p. 49-64.

Various techniques used to study the uranium-zirconium system, and the important part played by metallography. (M24b, 1-4; U, Zr)

133-M. A Preliminary Report on the Uranium-Carbon System. B. Blumenthal. Paper from "Tenth Metallographic Group Meeting", Oct. 24, 1955. *U.S. Atomic Energy Commission*, TID-7523 (Pt. 1), Dec. 1956, p. 65-66.

The investigation is concerned with the system at low carbon concentrations. The liquation experiments resulted in a liquidus curve at lower carbon concentrations than the saturation experiments. (M24b; U, C)

134-M. Metallography for the Geneva Reactor Fuel Elements. R. J. Gray. Paper from "Tenth Metallographic Group Meeting", Oct. 24, 1955. *U.S. Atomic Energy Commission*, TID-7523 (Pt 1), Dec. 1956, p. 67-73.

Metallographic work concerned in the development of fuel elements. A major problem which was encountered in the fabrication of the elements is also discussed, and some photographs and photomicrographs are presented which illustrate the difficulties encountered. (M general, T11g)

135-M. Techniques for the Metallography of High-Purity Aluminium. T. K. Roche. Paper from "Tenth Metallographic Group Meeting", Oct. 24, 1955. *U.S. Atomic Energy Commission*, TID-7523 (Pt. 1), Dec. 1956, p. 91-98.

Basically, the three techniques that are being used for the metallographic work are: (1) electropolishing; (2) anodization; and (3) the use of etch pits. Electropolishing and anodizing the specimens followed by examination under bright-field illumination permit the determination of such things as the amount of deformed material, the degree of recrystallization, and the grain size of the recrystallized material in the extruded bars. The use of etch pits affords some idea of the preferred orientation developed in the bars. The mechanics and results of each technique are described. (M20p, M20q; Al-a)

136-M. Constitution of Uranium and the Platinum Metals. J. J. Park and R. W. Buzzard. Paper from "Metallurgical Information Meeting, Ames Laboratory", May 1956. *U.S. Atomic Energy Commission*, TID-7526 (Pt. 1), Feb. 1957, p. 89-102.

Progress of the investigations of the constitution of uranium and the platinum metals (Ru, Rh, Pd, Os, Ir, and Pt). The solubilities of these and other transition metals in uranium are compared on the basis of radii, electronegativity, and comparable electronic structures of the ions. (M24b, M25, P15; U, EG-c)

137-M. Preferred Orientation in Extruded Thorium Rod. L. K. Jetter and C. J. McHargue. Paper from "Metallurgical Information Meeting, Ames Laboratory", May 1956. *U.S. Atomic Energy Commission*, TID-7526 (Pt. 1), Feb. 1957, p. 150-164.

Complete fiber axis distributions have been determined for thorium rods extruded at rates from 1 to 600 ft. per min. at 850° C. and for these rods annealed at 750° C. The mechanical properties were determined and a correlation between properties and texture was established. (M26c, Q general; Th, 4-8)

138-M. The Microstructural Appearance and Identification of Hydrides in Zirconium and Zircaloy-2 Hydrogen Alloys. G. B. Wadsworth, M. L. Picklesimer and G. M. Adamson, Jr. Paper from "Metallurgical Information Meeting, Ames Laboratory", May 1956. *U.S. Atomic Energy Commission*, TID-7526 (Pt. 1), Feb. 1957, p. 186-208.

A procedure for the positive identification and location of hydrides in crystal bar zirconium and Zircaloy-2 has been found. The hydride identification technique has been applied to specimens used for mechanical property determinations and radiation damage evaluations. (M27d, S19; Zr, 14-18)

139-M. (Italian.) **Structure and Properties of Metals. Part I. Theory of Ideal Metals.** R. Fieschi and M. Tosi. *Ingegneria Meccanica*, v. 5, July 1956, p. 49-55.

With properties of atoms and interatomic forces as starting point, character of ideal solids is studied. Theory of electronic bands in solids permits explanation of electrical and thermal properties of matter and differences between conductors and insulators. (To be continued.) (M25, P15)

140-M. (Russian.) **Investigation of the System Zirconium-Tantalum.** V. S. Emel'yanov, Yu. G. Godin and A. I. Evstyukhin. *Atomnaya energiya*, v. 2, no. 1, Jan. 1957, p. 42-47. (CMA)

Alloy samples were prepared from iodide zirconium and 99% pure tantalum by melting in an electric-arc furnace in an argon atmosphere. The diagram of the system zirconium-tantalum belongs to the eutectic type with restricted solid solution fields. The eutectic forms at 34 at. % Ta and 1585° C. There exists also a eutectoid transformation beta →alpha + gamma at 7 at. % Ta and 790° C., alpha, beta and gamma being solid solutions based, respectively, on alpha-Zr, beta-Zr and tantalum. The maximum solubility of tantalum in beta-zirconium at the eutectic temperature is 16 at. %, while the maximum solubility of zirconium in tantalum at the same temperature is 17 at. %. The maximum solubility of tantalum in alpha-zirconium at the eutectoid temperature is less than 0.22 at. %. 9 ref. (M24b, Zr, Ta)

141-M. Note on the Effect of Additions of Manganese and Chromium on the Microstructure of D.T.D. 687A-Type Alloys. M. K. B. Day. *Institute of Metals Journal*, v. 24, Feb. 1957, p. 263-264.

Examines microstructures of slowly cooled aluminum alloys. Melts of basic composition Zn 5.75, Mg 2.5, Cu 1.25, Fe 0.2, Si 0.2% with small quantities of manganese or chromium added and determined boundary of primary aluminum phase field. Approximate limits on chromium, manganese and iron content to avoid formation of brittle segregates. (M27b, 1-10; Al, *Mn, Cr*)

142-M. Preferred Orientation in Extruded Uranium Rod. L. K. Jetter and C. J. McHargue. *Journal of Metals*, v. 9, Feb. 1957, p. 291-292.

Results of study on the texture of uranium rod. Extruded at 500° C., deformation is duplex, components being near <031> and 10° from <410>. Deformation of rod extruded at 500° C. and annealed at 550° C. is also duplex, one component being near <431> and the other being 13° from <100> and 17° from <410>. 7 ref. (M26c; U, 4-8)

143-M. X-Ray Microscopy of As-Grown and Deformed Single Crystals of Aluminum. J. H. Auld, R. A. Coyle, A. M. Marshall and N. A. McKinnon. *Journal of Metals*, v. 9; *AIME Transactions*, v. 209, Mar. 1957, p. 360-361.

Brief note tells of detection of primary slip bands and kink bands by X-ray micrograph of aluminum crystal. (M21f; Al, 14-11)

144-M. Non-Destructive Method for Assessing Fracture Quality. Dr. H. Kessler and H. Winterstein. *Light Metals*, v. 20, Feb. 1957, p. 64-65.

Errors in evaluation of structural properties of aluminum casting alloys by microscopic examination and conclusions on fracture structure drawn from macrostructure revealed by etching. (M28, M20q; Al, 5)

145-M. (Italian.) **A New Etching Method for Color Metallography of Light Alloys Containing Copper.** M. Leoni. *Alluminio*, v. 26, Jan. 1957, p. 5-9.

New grain coloration method permits observation of various phases in specimen, as well as degree of homogeneity of solid solution and reciprocal grain orientation. 11 ref. (M20q; Al, *Cu*)

146-M. (Book.) **Technical Papers of the Tenth Metallographic Group Meeting Held at Knolls Atomic Power Laboratory Oct. 24, 1955.** H. P. Roth. *U.S. Atomic Energy Commission* TID-7523 (Pt. 1), Dec. 1955, 100 p.

Papers abstracted separately. (M general)

147-M. (Book.) **Elementary Crystallography.** M. J. Buerger. 528 p. 1956. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $8.75.

First half of the book is devoted to a rational development of the megascopically observable symmetries of crystals; the second part discusses the internal symmetries of crystals; in the third section the author introduces advanced material on group theory and its applications to symmetry; the space group theory is presented here without the use of extensive mathematics. (M26)

Transformations and Resulting Structures

137-N. Grain Growth in Steels. Role of Aluminium Nitride (Pt. 2). A. B. Chatterjea and B. R. Nijhawan. *Met-*

al Treatment and Drop Forging, v. 24, Feb. 1957, p. 54-60.

Analysis of published information and supplementary data obtained indicated aluminum nitride as a grain-growth inhibitor accounting for austenitic grain-refining characteristics of aluminum-killed steels. (N3; St-c)

138-N. The Periodicity of Dissociation of Solid Solutions. *Metal Treatment and Drop Forging*, v. 24, Feb. 1957, p. 70-71.

Dissociation of austenite in steel under isothermal heating and the periodic variation in hardness values. (N8g, Q29n; ST)

139-N. Production of Thorium-Bismuth Dispersions. J. S. Bryner, R. J. Teitel and M. B. Brodsky. Paper from "Metallurgical Information Meeting, Ames Laboratory", May 1956. *U.S. Atomic Energy Commission*, TID-7526 (Pt. 1), Feb. 1957, p. 103-114.

Methods by which dispersions of equiaxed particles of thorium bismuthide in liquid bismuth have been produced on a laboratory scale. These methods include various modifications of the reaction of solid thorium with liquid bismuth and a new method by which the dispersions can be produced from a solution of thorium in liquid bismuth. (N12; Th, Bi)

140-N. Morphology of Zircaloy-2. M. L. Picklesimer and G. M. Adamson, Jr. Paper from "Metallurgical Information Meeting, Ames Laboratory", May 1956. *U.S. Atomic Energy Commission*, TID-7526 (Pt. 1), Feb. 1957, p. 165-185.

Zircaloy-2 specimens were given a wide variety of conventional heat treatments. The microstructures show the effect of cooling rates on the beta to alpha transformation, effect of annealing time and temperature on the beta quenched structure, development of a partially randomizing heat treatment, grain growth in the alpha and beta phases. The microstructure of a multiphase weld is shown and compared to the conventionally heat treated structures. (N6p, M27, 2-14; Zr)

141-N. (French.) **Structure of Tin Deposits Obtained by Electrolysis.** J. J. Trillat, S. C. Britton, K. Mihama and S. Barbezat. *Metaux-Corrosion-Industries*, v. 32, Jan. 1957, p. 1-9.

Analyzes structure of electrolytic deposits of tin by means of an electron microscope and by X-ray diffraction; experimental techniques employed; close relationship is noted between the orientation of the deposits. 7 ref. (N12d, M21e, M22g; Sn)

142-N. (German.) **Formation of Coarse-Grained Aluminum With Trace Elements.** F. Erdmann-Jesnitzer and H. Schönberg. *Aluminium*, v. 33, Jan. 1957, p. 6-15.

Recrystallization experiments on high-purity aluminum containing small quantities of alloying element described to show whether these elements affect the deformed crystal structure through diffusion. 34 ref. (N5, 1-10; Al-a)

143-N. (Italian.) **Electron Microscope Examination of Hardening Phases in a Binary Al, 5% Cu Alloy.** M. Paganelli and E. Dalle Nogare. *Alluminio*, v. 26, Feb. 1957, p. 51-58.

In naturally aged alloy an increase occurs in number of "white points", corresponding to Guinier-Preston zones, as length of aging period increases. In same alloy artificially aged at 190° C., the Cu Al_2 phases were observed. 29 ref. (N7a; Al, *Cu*)

144-N. (Italian.) **Polymorphism of Metals and Influence of Alloying Elements on Same.** W. Köster. *Metallurgia Italiana*, v. 49, Jan. 1957, p. 14-23.

Nature and identification of polymorphism; mechanism of transformation; influence of additions; iron, cobalt and titanium alloy transformations; polymorphism of manganese. 16 ref. (N6p, 2-10; Fe, Co, Ti, Mn)

145-N. (Spanish.) **Influence of Vanadium on Susceptibility to Austenitic Grain Growth.** Justo Ferrer Flotats. From "Papers Presented at the 3rd General Assembly of the Iron and Steel Institute". 1956. 10 p.

Comparative study made on nine steels of different origins by tracing their respective curves and making photomicrographs of given singular points on same. Vanadium steels showed reduced susceptibility to grain growth from overheating and a smaller initial grain. 10 ref. (N3, 2-10; AY, *V*)

146-N. Origin of Graphite in Cast Irons. (Pt. 2). J. E. Harris and V. Kondic. *Foundry Trade Journal*, v. 102, Mar. 7, 1957, p. 311-314.

Discussion of experimental results. Evidence indicates graphite shapes and distributions observed to form in hypo-eutectic cast irons during normal process of solidification can be produced by decomposition of iron carbide in solid state, lending support to indirect hypothesis for origin of graphite. (N8s; CI)

147-N. Pearlite-Austenite Change. Conversion by Heating Effect of Electric Current. P. G. Morgan. *Iron and Steel*, v. 30, Mar. 1957, p. 108.

Brief note on alpha to gamma conversion in carbon steel by heating effect of electric current giving temperature elongation and electrical resistance changes. (N8h, 16-11; ST)

148-N. Carbide Precipitation in Tungsten-Chromium Steels Below 700° C. Kehsin Kuo. *Iron and Steel Institute Journal*, v. 185, Mar. 1957, p. 297-303.

X-ray and chemical analyses were carried out on carbides extracted electrolytically from steels containing up to 15% tungsten and 12% chromium. All these carbides were derived from the respective carbides in tungsten and chromium steels. Carbide phase-changes discussed in terms of the compositions of the matrix and the carbides. 21 ref. (N7; AY, *Cr, W*, 14-18)

149-N. Nature of Ageing of Binary Iron-Chromium Alloys Around 500° C. R. O. Williams and H. W. Paxton. *Iron and Steel Institute Journal*, v. 185, Mar. 1957, p. 358-374.

Investigation of aging (475° C. embrittlement) of iron-chromium alloys carried out using electrical resistance, hardness, magnetic measurements, and X-ray difraction. On the basis of this work it is concluded that a miscibility gap exists below 600° C. and is joined by one or two eutectoid reactions to the sigma-forming regions. Chemical and/or magnetic energies may be responsible for the gap and perhaps account for the odd shape. 37 ref. (N7a, Q26s; Fe, *Cr*)

150-N. Observation of Phase Transformation by High Temperature Microscopy. Kazuo Zutani. *Japan Society of Mechanical Engineers, Journal*, v. 60, Feb. 1957, p. 162-168.

Observation of martensite transformation, pearlite transformation and bainite transformation by means of high-temperature microscopy. From the results of the observations the bainite transformation appears to be controlled by the diffusion of carbon atom. (N8, M21, 2-12; ST)

151-N. (French.) **Development During Heating of Martensite of Thermal Origin in Steels of 18% Chromium, 2, 4 or 6% Nickel and 0.05% Carbon.** Paul Bastien and Alain Sulmont. *Comptes Rendus*, v. 243, Dec. 17, 1956, p. 2065-2068.

Two steps are distinguished, one consisting of a decomposition of the martensite in two phases, alpha and gamma, and the other the dissolving of the alpha by gamma. 4 ref. (N8p; SS)

152-N. (Japanese.) **Some Consideration on the Aging of Steel and Iron.** Shigeo Zaima and Sadaharu Mitsuishi. *Japan Society of Mechanical Engineers, Transactions*, v. 23, Feb. 1957, p. 108-110.

Change of magnetic properties with time in 1.29% carbon steel, 0.304% carbon steel and pearlite cast iron which was tempered between 100 and 300° C. with 50° C. intervals. Table of hysteresis loss shown. (N27a, P16; CN, CI)

Physical Properties

137-P. Heat of Formation and Entropy of Titanium Tetrachloride. W. F. Krieve, et al. California Institute of Technology, Jet Propulsion Laboratory. Report 20-219. Jan. 1954. *U.S. Office of Technical Services*, PB 121734, 17 p. (CMA)

The heat of formation of $TiCl_4$ was determined by direct chlorination, using the spontaneity of the reaction with titanium. The solubility of chlorine in $TiCl_4$ was determined to provide data for volumetric corrections and corrections for the heat of solution. Equipment is described. (P12s; Ti, 14-18)

138-P. Low-Pressure Solubility and Diffusion of Hydrogen in Zirconium. M. W. Mallett and W. M. Albrecht. *Electrochemical Society Journal*, v. 104, Mar. 1957, p. 142-146. (CMA)

Hydrogen solubility in alpha and beta Zr and in two zirconium-oxygen alloys determined at low pressures in the range from 700 to 1000° C. Hydrogen solubility increases with increasing oxygen content and decreasing temperature. Diffusion coefficients in alpha-zirconium were determined for the 300 to 600° C. range and degassing coefficients for 600 to 800° C. The latter were lower than expected, indicating that degassing does not proceed purely by diffusion. (P12e, N1; Zr, *H*)

139-P. New Test Checks Electroplating Porosity. F. Ogburn. *Iron Age*, v. 179, Mar. 7, 1957, p. 123-126.

Radiographic tests of plating were made with radio-isotopes of iron, cobalt or nickel or by X-ray exposure.

Technique can be useful in detecting discontinuities in coating. Method limited by basis metal, uniformity and thickness and by grain size of film used.
(P10m, 1-4; Fe, Co, Ni, 8-12, 14-13)

140-P. Annealing of Cold-Worked Copper by Electron Irradiation. C. J. Meechan. *Journal of Applied Physics,* v. 28, Feb. 1957, p. 197-200.

Copper wires were cold worked at room temperature to approximately 15% reduction in area and were then irradiated at temperatures between 100 and 150° C. with 1.25-megelectron volts. The residual resistivity was observed to decrease as a function of exposure at temperatures above 100° C. The higher the temperature at which the irradiation was performed, the greater was the rate of resistivity decrease.
(P15g, 2-17, 2-11; Cu)

141-P. Thermionic Constants and Sorption Properties of Hafnium. H. D. Hagstrum. *Journal of Applied Physics,* v. 28, Mar. 1957, p. 323-328. (CMA)

The thermionic emission of hafnium was measured in the range from 1250 to 1820° K. No gas was desorbed when hafnium was flashed to 2150° K. after cooling for 64 hr. Electron ejection measurements on an oxygen-contaminated hafnium sample indicated that the surface was covered with an appreciable monolayer after cooling from high temperature. The work function increases as the metal irreversibly absorbs gas on heating.
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Magnetic susceptibilities of pure copper and dilute copper-nickel alloys containing 0.59, 1.16 and 2.48 at. % nickel measured by a Gouy method at temperatures between 295 and 2.5° K. At room temperature all the alloys were found to be diamagnetic, the numerical value of the susceptibility decreasing with increasing nickel content. The paramagnetic contributions found at low temperatures were considerably smaller than previously reported.
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143-P. Transport Properties of Dilute Binary Magnesium Alloys. Edward I. Salkovitz, Albert I. Schindlter and Erwin W. Kammer. *Physical Review,* v. 105, Feb. 1, 1957, p. 887-896.

If the overlap model is even only qualitatively correct, measurement of electron transport properties should be sensitive to electron overlap. Such measurements were made on the resistivity, temperature variation of resistivity, Hall coefficient, and thermoelectric power. (P15; Mg)

144-P. On the Complex Permeability of Iron-Nickel Alloys at High Temperatures. J. C. Anderson and B. Donovan. *Physical Society, Proceedings, Section B.,* v. 70, Pt. 2, Feb. 1957, p. 180-191.

The real and imaginary parts of the complex permeability have been measured for a series of iron-nickel alloys in the frequency range 300-400 megacycles per sec. The frequency of the internal resonance observable in this region has been investigated as a function of compositions and is found to pass through a minimum in the neighborhood of 70% nickel.
(P16q, 2-10; Fe, Ni)

145-P. Physical Properties of Magnesium Fluoride Slag. D. S. Arnold. Paper from "Processing of Uranium—Magnesium Fluoride Slag", *U.S. Atomic Energy Commission,* TID-7528 (Pt. 1), Dec. 1956, p. 1-11.

Physical properties. X-ray diffraction and microscopic examinations indicating nature of the uranium dispersion in the slag demonstrate that the uranium occurs in the slag as highly dispersed, very fine globules of either uranium metal or uranium oxide. 7 ref.
(P general, N12; U, RM-q)

146-P. Wetting Temperatures of Fuel Element Components With Sodium and NaK. G. G. Bentle, H. Strahl and J. Droher. Paper from "Metallurgical Information Meeting, Ames Laboratory", *U.S. Atomic Energy Commission,* TID-7526 (Pt. 1), Feb. 1957, p. 16-27.

The temperatures of wetting of stainless steel, uranium, thorium, and thorium-uranium alloys with sodium and sodium-potassium alloy determined. The parameters of surface condition, wetting fluid, and composition of material investigated as to their effect on wetting temperatures. Cyclographic tests of fuel elements in which sodium or sodium potassium alloy is the bonding fluid are reported. 7 ref.
(P13, T11g; SS, U, Th, *Na*)

147-P. Effect of Variation of Temperature and Pressure on Composition of Alloys. W. M. Spicer. Georgia Institute of Technology (U.S. Air Research and Development Command), *U.S. Office of Technical Services,* PB 121235, 1955, 56 p.

Theoretical prediction that a concentration gradient develops in a solid alloy as a result of a temperature change. The basis for the research was the assumption that a change in composition may develop in a portion of an alloy of uniform composition if the remainder of the alloy is held at a different temperature or subjected to a high pressure. Results of the temperature effect, especially on lead-tin and aluminum-zinc alloys, indicated that a concentration change did develop with the temperature gradient.
(P12, 2-11, 3-24; Al, *Zn*)

148-P. (English.) **Thermal Conductance of Contracts Between Aluminum and Other Metals.** F. Boeshoten and E. F. Van Der Held. *Physica,* v. 23, Jan. 1957, p. 37-44.

Coefficient of heat transfer of a joint between aluminum and aluminum, steel and uranium respectively, measured. The gap between the metal surfaces was filled with air, helium or hydrogen of gas pressures varying between 1 and 750 mm. Hg. Some oils were introduced in the joint. 5 ref. (P11h; Al, ST, U)

149-P. (English.) **Measurements on the Magnetic Susceptibility of White Tin and Copper Down to Liquid Helium Temperatures.** A. Van Itterback and W. Duchateau. *Physica,* v. 23, Jan. 1957, p. 169-172.

Measurements carried out on the magnetic susceptibility of pure tin (polycrystalline and a single crystal) and copper between room temperature and 2° K. For the polycrystalline tin, which is paramagnetic, a decrease of 16% is found for the susceptibility between room temperature and 2° K. For a single crystal of tin only a decrease of 10% was found. (P16, 2-13; Sn, Cu)

150-P. (English.) **Thermal Expansion Coefficient, Rigidity Modulus and Its Temperature Coefficient of the Alloys of Iron, Nickel, Cobalt and Chrominum and Relation of Super-Invar to Stainless Invar and of Elinvar to Co-Elinvar.** Hakaru Masumoto, Hideo Saito, Tatsuo Kono and Yutaka Sugai. *Tohoku University, Science Reports of the Research Institutes,* v. 8A, Dec. 1956, p. 471-483.

There are two ranges of the minimum values of the expansion coefficient or the maximum values of the positive temperature coefficient of the modulus, one of which originates at the composition of Invar, that is, in the neighborhood of the composition of super Invar, or Elinvar in the binary system of iron and nickel, and the other at those of stainless Invar or Co-Elinvar in the ternary system of iron, cobalt and chromium.
(P11g, Q21; Fe, Ni, Co, Cr, SGA-n)

151-P. (English.) **Thermodynamic Activities in Iron-Cobalt Solid Solutions.** Tsuneo Satow, Sukeji Kachi and Keizo Iwase. *Tohoku University, Science Reports of the Research Institutes,* v. 8A, Dec. 1956, p. 502-510.

Thermodynamic properties of gamma, alpha and superlattice phases of iron-cobalt alloys were studied from the equilibrium among water, hydrogen and various alloys. The heat of mixing in the gamma phase showed almost ideal behavior, and activity obeyed Raoult's Law. In the alpha phase, the activity showed negative deviation from Raoult's Law. (P12b; Fe, Co, 14-17)

152-P. (French.) **Absorption Spectra K of Palladium in the Pure Metal and in the Alloys Pd-Au.** Chintamani Mande. *Comptes Rendus,* v. 244, Feb. 4, 1957, p. 747-749.

Studies the forms of the discontinuities K palladium in pure palladium and in the two alloys Pd-Au. For the first time the discontinuity K of palladium has been resolved.
(P17e, S11k; Pd, Au)

153-P. Thermal and Electrical Conductivity of Rhodium, Iridium, and Platinum. G. K. White and S. B. Woods. *Canadian Journal of Physics,* v. 35, Mar. 1957, p. 248-257.

Rapid rate of decrease of the "ideal" thermal and electrical resistivities with temperature, particularly in rhodium and iridium, suggests that s-d transitions are not a dominant resistive mechanism at low temperatures in these metals, in contrast to palladium, iron and nickel. 19 ref. (P11h, P15g; Rh, Ir, Pt)

154-P. Electrical Resistance of Some Metals and Alloys Below 1° K. J. S. Dugdale and D. K. C. MacDonald. *Canadian Journal of Physics,* v. 35, Mar. 1957, p. 271-279.

Measurements of electrical resistance below 1° K. are described, including experiments to estimate the thermal contact resistance between the paramagnetic salt and gold wires which were subsequently used as secondary thermometers; the resistance of a dilute copper alloy, a lithium-magnesium alloy, and a sodium specimen was measured. 14 ref.
(P15g, 2-13; Cu, Li, Mg, Na)

155-P. New Type of Magnetic Transition in Mn_2ZnC. B. N. Brockhouse and H. P. Myers. *Canadian Journal of Physics,* v. 35, Mar. 1957, p. 313-323.

Alloys with the approximate composition of manganese, zinc-carbon (Mn_2ZrC) are known to be ferromagnetic but the saturation magnetization shows a maximum in the region of 231° K.; X-ray and neutron diffraction measurements are reported which demonstrate that at 231° K. there is a second order transition below which ordering of the manganese ions occurs, resulting in a tetragonal distortion of the normally cubic lattice and a complex magnetic structure; one possible magnetic structure is discussed. 14 ref. (P16, N11h; Mn, Zn)

156-P. Conductivity of Alpha-Manganese. G. K. White and S. B. Woods. *Canadian Journal of Physics*, v. 35, Mar. 1957, p. 346-348.

Measurements of electrical and thermal resistance on electrolytic flake manganese in a cryostat which could be controlled at temperatures from 2° K. up to room temperature. 14 ref. (P11h, P15g; Mn)

157-P. Program for Fundamental Research in Hard Metals. Pol Duwez. *Journal of Metals*, v. 9, Feb. 1957, p. 250-251.

Need for a systematic study of physical properties of hard metals as an aid to the metallurgist. Brief discussion of the theory of atomic bonding, and possibilities of paramagnetic resonance spectroscopy. (P general, M25; EG-d37)

158-P. (German.) **New Methods in Thermodynamics and in the Calorimetry of Alloys. Their Applications to Iron and Steel.** W. Oelsen and B. Schurmann. *Giesserei*, v. 44, Feb. 28, 1957, p. 113-120.

Significance of the theory of heat for the metallurgist and foundryman. The present state of calorimetry. Conclusions drawn from the heat content curves of lead-cadmium alloys. Latest development of the Bunsen ice calorimeter. Heat content curves of iron-carbon alloys. Measurement of the change in volume and the magnetic properties in the calorimeter. (P12, X24; Fe, ST)

159-P. (Book.) **Metallurgical Thermochemistry.** O. Kubaschewski and E. Ll. Evans. 410 p. 1956. John Wiley and Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $10.00.

The first section of the book discusses the theoretical basis, and consists largely of formulas necessary for applying fundamental data to reaction problems. Following this, the authors describe the main experimental techniques used to determine the thermochemical data, and point out the relative advantages and disadvantages of the various methods. A third section describes methods of estimating values that cannot ordinarily be determined. In Part 4, the authors supply, via tabular form, the values of thermochemical constants for a large number of elements and compounds of possible metallurgical importance. The final section of the book contains examples of the practical applications of thermochemical methods. (P13, P12)

Q Mechanical Properties and Tests

371-Q. Materials—Key to Superspeed Aircraft. *ASTM Bulletin*, No. 220, Feb. 1957, p. 18-20.

Problems of superspeed, and testing materials and assemblies at high temperature. (Q general, 2-12, T24, SGA-h)

372-Q. Theory of Plastic Deformation of Metals. N. S. Akulow and P. P. Galenko. *British Atomic Energy Research Establishment*, A.E.R.E. Lib/Trans 672, Aug. 1956, 4 p. (Translated from *Doklady Akademii Nauk SSR*, v. 103, July 1955, p. 387-390).

Previously abstracted from original. See item 973-Q, 1955. (Q24)

373-Q. How Ceramic Coatings Affect Creep of Alloys. *Ceramic Industry*, v. 68, March 1957, p. 58, 94, 95.

Creep curves for two coated and uncoated 80% Ni, 20% Cr alloys under stress at an elevated temperature. Results show that the beneficial effect on the creep behavior of both alloys is sufficient to be of practical importance. (Q3m; Ni, Cr, 8-21)

374-Q. Effect of Interrupted Loading on Mechanical Properties of Metals. E. V. Evans. *Engineer*, Feb. 22, 1957, p. 292-294.

For a range of metals increased elongation of fracture may be obtained in tensile tests if the specimen is repeatedly loaded and unloaded, the strain increasing by small increments in each cycle. (Q27e)

375-Q. Metallurgy of Cutting Tools, Part II—Heat Measurement and Hot Hardness. K. G. Lewis. *Iron and Coal Trade Review*, v. 174, Feb. 15, 1957, p. 399-404.

Comparison of some methods used to measure the heat developed in cutting. There are three properties of cutting tools which greatly affect their machining ability—hot hardness, toughness and wear resistance. Hot hardness is discussed in this part. (Q19p; SGA-j)

376-Q. Properties of Silicon Diffusion Coating. A. S. Akopdzhanyan and N. S. Garbundy. *Journal of Applied Chemistry of the USSR*, v. 29, May 1956, p. 717-720. (Translated by Consultants Bureau, 227 W. 17th St., New York 11, N.Y.)

Silicon-coated iron is resistant to the action of such corrosive media as 10% aqueous solutions of sulphuric, hydrochloric and phosphoric acids, and aqueous solutions of 3% sodium chloride, 5% calcium chloride, and 5% sodium sulphate. Microhardness and abrasion tests showed that diffusion layers of silicon have considerably higher hardness and wear resistance than original iron. (Q29n, Q9n; Fe, *Si*, 8-24)

377-Q. Compressional Creep of Tin Single Crystals. J. Weertman. *Journal of Applied Physics*, v. 28, Feb. 1957, p. 196-197.

Compressional creep tests were run on single crystals oriented so that the direction of compression was along the C axis. Two activation energies of creep were found; approximately 24,500 cal. per mol above 120° C. and 12,000 cal. per mol below this temperature. (Q3c; Sn, 14-11)

378-Q. On Primary Creep. N. J. Hoff. *Journal of the Mechanics and Physics of Solids*, v. 5, Mar. 1957, p. 150-151.

To show that the presence of variations in the properties of the individual crystals of a polycrystalline aggregate the assumption that only two mechanisms of deformation exist, namely one of linear elasticity and one of nonlinear steady (or secondary) creep suffices to explain the existence of primary (or transient) creep. (Q3)

379-Q. Study on Magnesium Alloys Containing Zirconium. I. On the Properties of Rolled Mg-Zr Alloys. H. Tanaka and K. Soutome. *Light Metals (Tokyo)*, v. 7, Jan. 1957, p. 62-68. (CMA)

The addition of zirconium to wrought (rolled) magnesium alloys was studied. The refined ingot structure resulted in better ingot working. Strength of the orientation decreases as the amount of zirconium increases. Ductility was improved and the recrystallization temperature was increased. (Q23p, N5; Mg, *Zr*, 4)

380-Q. Fatigue of Aircraft. P. L. Teed. *Machinery Lloyd*, v. 29, Feb. 16, 1957, p. 70-78.

Fatigue of aircraft from the viewpoint of stress concentrations and built-in stress. (Q7, T24)

381-Q. Neutron Radiation Effects on Tensile and Impact Properties of ASTM-A302 B Steel. E. E. Baldwin. *Mechanical Engineering*, v. 79, March 1957, p. 261-265.

Effect of the operating conditions of temperature and radiation upon the tensile and impact strengths of the structural material to be used for pressurized-water-reactor pressure vessels. (Q27a, Q6n, 2-17, W11, 17-7)

382-Q. Cracking Tendency in Heavy High-Temperature Steam Piping. Henry M. Soldan and Charles R. Mayne. *Metal Progress*, v. 71, Mar. 1957, p. 78-85.

Stabilized 18-8 (Type 347) is the conventional material for high-temperature steam service. Occasional cracks alongside welds may be avoided by using metal and welding electrodes (like 16-8-2 Cr-Ni-Mo) which have 60% reduction of area or more when cooled from 2400° F. and tested at 2300° F. (Q23p, 2-12; SS, 1-7, 9-22)

383-Q. Brittle Fracture of Sheet Piling. W. A. Morgan and R. C. A. Thurston. *Metal Progress*, v. 71, Mar. 1957, p. 86-91.

Sheet piling is usually rolled of structural steel which can meet moderate requirements. While service records are good, several failures in Canadian waters indicate that its transition temperature, where fatigue cracks or corrosion pits lead to catastrophic brittle fracture, is well above the water temperature. (Q26s, T26; AY, CN)

384-Q. Testing Quality of Spring Steel. William R. Johnson. *Steel*, v. 140, Mar. 11, 1957, p. 185-188.

Special set point test, fatigue test, formability test and break test are used, with hardness and microstructure testing, to determine steels suitable for springs. (Q general; ST, SGA-b)

385-Q. The Strengthening of Beryllium for High-Temperature Use by Means of Beryllium Oxide and Beryllium Carbide Dispersions. J. Greenspan. Paper from "Metallurgical Information Meeting, Ames Laboratory", May 1956. *U.S. Atomic Engery Commission*, TID-7526 (Pt. 1), p. 34-53.

The high-temperature rupture life of beryllium is extended considerably when small percentages of either oxide or carbide particles are well dispersed throughout the metal. Correlations are shown between stress-rupture results and micro-

Technique can be useful in detecting discontinuities in coating. Method limited by basis metal, uniformity and thickness and by grain size of film used.
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148-P. (English.) **Thermal Conductance of Contracts Between Aluminum and Other Metals.** F. Boeshoten and E. F. Van Der Held. *Physica,* v. 23, Jan. 1957, p. 37-44.

Coefficient of heat transfer of a joint between aluminum and aluminum, steel and uranium respectively, measured. The gap between the metal surfaces was filled with air, helium or hydrogen of gas pressures varying between 1 and 750 mm. Hg. Some oils were introduced in the joint. 5 ref. (P11h; Al, ST, U)

149-P. (English.) **Measurements on the Magnetic Susceptibility of White Tin and Copper Down to Liquid Helium Temperatures.** A. Van Itterback and W. Duchateau. *Physica,* v. 23, Jan. 1957, p. 169-172.

Measurements carried out on the magnetic susceptibility of pure tin (polycrystalline and a single crystal) and copper between room temperature and 2° K. For the polycrystalline tin, which is paramagnetic, a decrease of 16% is found for the susceptibility between room temperature and 2° K. For a single crystal of tin only a decrease of 10% was found. (P16, 2-13; Sn, Cu)

150-P. (English.) **Thermal Expansion Coefficient, Rigidity Modulus and Its Temperature Coefficient of the Alloys of Iron, Nickel, Cobalt and Chrominum and Relation of Super-Invar to Stainless Invar and of Elinvar to Co-Elinvar.** Hakaru Masumoto, Hideo Saito, Tatsuo Kono and Yutaka Sugai. *Tohoku University, Science Reports of the Research Institutes,* v. 8A, Dec. 1956, p. 471-483.

There are two ranges of the minimum values of the expansion coefficient or the maximum values of the positive temperature coefficient of the modulus, one of which originates at the composition of Invar, that is, in the neighborhood of the composition of super Invar, or Elinvar in the binary system of iron and nickel, and the other at those of stainless Invar or Co-Elinvar in the ternary system of iron, cobalt and chromium.
(P11g, Q21; Fe, Ni, Co, Cr, SGA-n)

151-P. (English.) **Thermodynamic Activities in Iron-Cobalt Solid Solutions.** Tsuneo Satow, Sukeji Kachi and Keizo Iwase. *Tohoku University, Science Reports of the Research Institutes,* v. 8A, Dec. 1956, p. 502-510.

Thermodynamic properties of gamma, alpha and superlattice phases of iron-cobalt alloys were studied from the equilibrium among water, hydrogen and various alloys. The heat of mixing in the gamma phase showed almost ideal behavior, and activity obeyed Raoult's Law. In the alpha phase, the activity showed negative deviation from Raoult's Law. (P12b; Fe, Co, 14-17)

152-P. (French.) **Absorption Spectra K of Palladium in the Pure Metal and in the Alloys Pd-Au.** Chintamani Mande. *Comptes Rendus,* v. 244, Feb. 4, 1957, p. 747-749.

Studies the forms of the discontinuities K palladium in pure palladium and in the two alloys Pd-Au. For the first time the discontinuity K of palladium has been resolved.
(P17e, S11k; Pd, Au)

153-P. Thermal and Electrical Conductivity of Rhodium, Iridium, and Platinum. G. K. White and S. B. Woods. *Canadian Journal of Physics,* v. 35, Mar. 1957, p. 248-257.

Rapid rate of decrease of the "ideal" thermal and electrical resistivities with temperature, particularly in rhodium and iridium, suggests that s-d transitions are not a dominant resistive mechanism at low temperatures in these metals, in contrast to palladium, iron and nickel. 19 ref. (P11h, P15g; Rh, Ir, Pt)

154-P. Electrical Resistance of Some Metals and Alloys Below 1° K. J. S. Dugdale and D. K. C. MacDonald. *Canadian Journal of Physics,* v. 35, Mar. 1957, p. 271-279.

Measurements of electrical resistance below 1° K. are described, including experiments to estimate the thermal contact resistance between the paramagnetic salt and gold wires which were subsequently used as secondary thermometers; the resistance of a dilute copper alloy, a lithium-magnesium alloy, and a sodium specimen was measured. 14 ref.
(P15g, 2-13; Cu, Li, Mg, Na)

155-P. New Type of Magnetic Transition in Mn_2ZnC. B. N. Brockhouse and H. P. Myers. *Canadian Journal of Physics,* v. 35, Mar. 1957, p. 313-323.

Alloys with the approximate composition of manganese, zinc-carbon (Mn_3ZrC) are known to be ferromagnetic but the saturation magnetization shows a maximum in the region of 231° K.; X-ray and neutron diffraction measurements are reported which demonstrate that at 231° K. there is a second order transition below which ordering of the manganese ions occurs, resulting in a tetragonal distortion of the normally cubic lattice and a complex magnetic structure; one possible magnetic structure is discussed. 14 ref. (P16, N11h; Mn, Zn)

156-P. Conductivity of Alpha-Manganese. G. K. White and S. B. Woods. *Canadian Journal of Physics*, v. 35, Mar. 1957, p. 346-348.

Measurements of electrical and thermal resistance on electrolytic flake manganese in a cryostat which could be controlled at temperatures from 2° K. up to room temperature. 14 ref. (P11h, P15g; Mn)

157-P. Program for Fundamental Research in Hard Metals. Pol Duwez. *Journal of Metals*, v. 9, Feb. 1957, p. 250-251.

Need for a systematic study of physical properties of hard metals as an aid to the metallurgist. Brief discussion of the theory of atomic bonding, and possibilities of paramagnetic resonance spectroscopy. (P general, M25; EG-d37)

158-P. (German.) **New Methods in Thermodynamics and in the Calorimetry of Alloys. Their Applications to Iron and Steel.** W. Oelsen and B. Schurmann. *Giesserei*, v. 44, Feb. 28, 1957, p. 113-120.

Significance of the theory of heat for the metallurgist and foundryman. The present state of calorimetry. Conclusions drawn from the heat content curves of lead-cadmium alloys. Latest development of the Bunsen ice calorimeter. Heat content curves of iron-carbon alloys. Measurement of the change in volume and the magnetic properties in the calorimeter. (P12, X24; Fe, ST)

159-P. (Book.) **Metallurgical Thermochemistry.** O. Kubaschewski and E. Ll. Evans. 410 p. 1956. John Wiley and Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $10.00.

The first section of the book discusses the theoretical basis, and consists largely of formulas necessary for applying fundamental data to reaction problems. Following this, the authors describe the main experimental techniques used to determine the thermochemical data, and point out the relative advantages and disadvantages of the various methods. A third section describes methods of estimating values that cannot ordinarily be determined. In Part 4, the authors supply, via tabular form, the values of thermochemical constants for a large number of elements and compounds of possible metallurgical importance. The final section of the book contains examples of the practical applications of thermochemical methods. (P13, P12)

Mechanical Properties and Tests

371-Q. Materials—Key to Superspeed Aircraft. *ASTM Bulletin*, No. 220, Feb. 1957, p. 18-20.

Problems of superspeed, and testing materials and assemblies at high temperature. (Q general, 2-12, T24, SGA-h)

372-Q. Theory of Plastic Deformation of Metals. N. S. Akulow and P. P. Galenko. *British Atomic Energy Research Establishment*, A.E.R.E. Lib/Trans 672, Aug. 1956, 4 p. (Translated from *Doklady Akademii Nauk SSR*, v. 103, July 1955, p. 387-390).

Previously abstracted from original. See item 973-Q, 1955. (Q24)

373-Q. How Ceramic Coatings Affect Creep of Alloys. *Ceramic Industry*, v. 68, March 1957, p. 58, 94, 95.

Creep curves for two coated and uncoated 80% Ni, 20% Cr alloys under stress at an elevated temperature. Results show that the beneficial effect on the creep behavior of both alloys is sufficient to be of practical importance. (Q3m; Ni, Cr, 8-21)

374-Q. Effect of Interrupted Loading on Mechanical Properties of Metals. E. V. Evans. *Engineer*, Feb. 22, 1957, p. 292-294.

For a range of metals increased elongation of fracture may be obtained in tensile tests if the specimen is repeatedly loaded and unloaded, the strain increasing by small increments in each cycle. (Q27e)

375-Q. Metallurgy of Cutting Tools, Part II—Heat Measurement and Hot Hardness. K. G. Lewis. *Iron and Coal Trade Review*, v. 174, Feb. 15, 1957, p. 399-404.

Comparison of some methods used to measure the heat developed in cutting. There are three properties of cutting tools which greatly affect their machining ability—hot hardness, toughness and wear resistance. Hot hardness is discussed in this part. (Q19p; SGA-j)

376-Q. Properties of Silicon Diffusion Coating. A. S. Akopdzhanyan and N. S. Garbundy. *Journal of Applied Chemistry of the USSR*, v. 29, May 1956, p. 717-720. (Translated by Consultants Bureau, 227 W. 17th St., New York 11, N.Y.)

Silicon-coated iron is resistant to the action of such corrosive media as 10% aqueous solutions of sulphuric, hydrochloric and phosphoric acids, and aqueous solutions of 3% sodium chloride, 5% calcium chloride, and 5% sodium sulphate. Microhardness and abrasion tests showed that diffusion layers of silicon have considerably higher hardness and wear resistance than original iron. (Q29n, Q9n; Fe, *Si*, 8-24)

377-Q. Compressional Creep of Tin Single Crystals. J. Weertman. *Journal of Applied Physics*, v. 28, Feb. 1957, p. 196-197.

Compressional creep tests were run on single crystals oriented so that the direction of compression was along the C axis. Two activation energies of creep were found; approximately 24,500 cal. per mol above 120° C. and 12,000 cal. per mol below this temperature. (Q3c; Sn, 14-11)

378-Q. On Primary Creep. N. J. Hoff. *Journal of the Mechanics and Physics of Solids*, v. 5, Mar. 1957, p. 150-151.

To show that the presence of variations in the properties of the individual crystals of a polycrystalline aggregate the assumption that only two mechanisms of deformation exist, namely one of linear elasticity and one of nonlinear steady (or secondary) creep suffices to explain the existence of primary (or transient) creep. (Q3)

379-Q. Study on Magnesium Alloys Containing Zirconium. I. On the Properties of Rolled Mg-Zr Alloys. H. Tanaka and K. Soutome. *Light Metals (Tokyo)*, v. 7, Jan. 1957, p. 62-68. (CMA)

The addition of zirconium to wrought (rolled) magnesium alloys was studied. The refined ingot structure resulted in better ingot working. Strength of the orientation decreases as the amount of zirconium increases. Ductility was improved and the recrystallization temperature was increased. (Q23p, N5; Mg, *Zr*, 4)

380-Q. Fatigue of Aircraft. P. L. Teed. *Machinery Lloyd*, v. 29, Feb. 16, 1957, p. 70-78.

Fatigue of aircraft from the viewpoint of stress concentrations and built-in stress. (Q7, T24)

381-Q. Neutron Radiation Effects on Tensile and Impact Properties of ASTM-A302 B Steel. E. E. Baldwin. *Mechanical Engineering*, v. 79, March 1957, p. 261-265.

Effect of the operating conditions of temperature and radiation upon the tensile and impact strengths of the structural material to be used for pressurized-water-reactor pressure vessels. (Q27a, Q6n, 2-17, W11, 17-7)

382-Q. Cracking Tendency in Heavy High-Temperature Steam Piping. Henry M. Soldan and Charles R. Mayne. *Metal Progress*, v. 71, Mar. 1957, p. 78-85.

Stabilized 18-8 (Type 347) is the conventional material for high-temperature steam service. Occasional cracks alongside welds may be avoided by using metal and welding electrodes (like 16-8-2 Cr-Ni-Mo) which have 60% reduction of area or more when cooled from 2400° F. and tested at 2300° F. (Q23p, 2-12; SS, 1-7, 9-22)

383-Q. Brittle Fracture of Sheet Piling. W. A. Morgan and R. C. A. Thurston. *Metal Progress*, v. 71, Mar. 1957, p. 86-91.

Sheet piling is usually rolled of structural steel which can meet moderate requirements. While service records are good, several failures in Canadian waters indicate that its transition temperature, where fatigue cracks or corrosion pits lead to catastrophic brittle fracture, is well above the water temperature. (Q26s, T26; AY, CN)

384-Q. Testing Quality of Spring Steel. William R. Johnson. *Steel*, v. 140, Mar. 11, 1957, p. 185-188.

Special set point test, fatigue test, formability test and break test are used, with hardness and microstructure testing, to determine steels suitable for springs. (Q general; ST, SGA-b)

385-Q. The Strengthening of Beryllium for High-Temperature Use by Means of Beryllium Oxide and Beryllium Carbide Dispersions. J. Greenspan. Paper from "Metallurgical Information Meeting, Ames Laboratory", May 1956. *U.S. Atomic Engery Commission*, TID-7526 (Pt. 1), p. 34-53.

The high-temperature rupture life of beryllium is extended considerably when small percentages of either oxide or carbide particles are well dispersed throughout the metal. Correlations are shown between stress-rupture results and micro-

structure and particle content. In the carbide group of alloys, some stress-rupture properties are plotted as a function of carbon content. 6 ref. (Q3m, 3-21; Be, SGA-h)

386-Q. Mechanical Properties of Reactor Grade Beryllium at Elevated Temperatures. R. G. O'Rourke, J. N. Hurd, K. G. Wikle and W. W. Beaver. Brush Beryllium Co. *U.S. Atomic Energy Commission,* COO-312, Aug. 1956, 142 p.

Mechanical properties of vacuum hot-pressed reactor-grade beryllium are summarized. This study covered the temperature range from 800 to 1500° F. and strain rates from 0.001 to 0.1 in. per in./per min. Addition of beryllium oxide to a level of 3% increases the mechanical strength of beryllium and improves stress-rupture and creep properties. At a total of 3% beryllium oxide, the equicohesive temperature of beryllium is increased about 200° F. over that expected for reactor-grade, beryllium containing 1% beryllium oxide. 19 ref.
(Q general, 2-12, Be)

387-Q. Microscopic Observations of High Purity Uranium Subjected to Thermal Cycling. R. M. Mayfield and L. T. Lloyd. Argonne National Laboratory. *U.S. Atomic Energy Commission,* ANL-5347, Sept. 15, 1956, 65 p.

Observations of the microstructural changes and deformation mechanisms which occur in coarse and fine-grained high-purity uranium as a result of heat treatments between room temperature and 500° C. indicate that thermal cycling growth embodies some of the features which have been observed in creep studies of aluminum. Coarse-grained specimens deformed by slip and twinning within the grains, as well as by grain boundary deformation.
(Q24; U)

388-Q. Microhardness Evaluation of Alpha Hot Rolled Uranium Rod for Drawing. M. T. McGown, H. S. Rubenstein and R. M. Treco. Paper from "Tenth Metallography Group Meeting". *U.S. Atomic Energy Commission,* TID-7523 (Pt. 1), Dec. 1956, p. 35-36.

A detailed microhardness investigation of hot rolled uranium rod before and after beta-treatment and drawing revealed the presence of nonuniform hardening throughout the cross-section. This investigation included compiling data to show radial and angular variations in hardness which might have been introduced during processing.
(Q29q, U, 4-5)

389-Q. Microstructure of Some Irradiated Nonfissionable Metals. C. A. Bruch and W. E. McHugh. Paper from "Tenth Metallographic Group Meeting". *U.S. Atomic Energy Commission,* TID-7523 (Pt. 1), Dec. 1956, p. 81-89.

Determination of neutron irradiation effect on some mechanical and physical properties of metals such as copper, nickel, iron, molybdenum, zirconium, and titanium.
(Q general, P general, 2-17; Cu, Ni, Fe, Mo, Zr, Ti)

390-Q. On the Mechanical Metallurgy of Zircaloy-3b. D. E. Johnson. Paper from "Metallurgical Information Meeting, Ames Laboratory", May 1956. *U.S. Atomic Energy Commission,* TID-7566 (Pt.1), Feb. 1957, p. 54-68.

Tensile test properties in the rolling direction were determined for Zircaloy-3b. Tensile tests were performed with specimens in the annealed condition and in several cold worked conditions at testing temperatures of −50, 22, 100, 200 and 300° C. (Q27a, 1-4; Zr)

391-Q. Mechanical Properties and Corrosion Behavior of Zircaloy-3. F. Forscher, S. Kass and K. Goldman. Paper from "Metallurgical Information Meeting, Ames Laboratory", May 1956, *U.S. Atomic Energy Commission,* TID-7526 (Pt. 1), Feb. 1957, p. 69-88.

Mechanical properties and corrosion behavior of four zirconium alloys, Zircaloys 2, 3A, 3B and 3C, compared. Strength and ductility properties are compared at several temperatures in several heat treatment conditions in the transverse and longitudinal directions. Compression, impact and hardness test results are also reported. 6 ref.
(Q general, R general, 2-11, 2-14; Zr)

392-Q. Effects of Interstitial Contaminants on the Notch-Tensile Properties of Titanium and Titanium Alloys—II. Alloy Titanium. E. P. Klier and N. J. Feola. U.S. Air Force. Wright Air Development Center. Technical Report 55-325, *U.S. Office of Technical Services,* PB 121575, Aug. 1956, 202 p. (CMA)

Six titanium alloys were studied for changes in the notch-tensile properties affected by the interstitial contaminants carbon, oxygen and nitrogen. Notch sensitivity depends on tensile strength and becomes potentially severe as the strength exceeds 150,000 psi. Alloy content and microstructure also have great effect. The other variables considered are test temperature, level of contamination and strain rate.
(Q27d, 3-19; Ti)

393-Q. Effect of Plastic Fatigue on Pressure-Vessel Materials and Design. L. F. Kooistra. *Welding Journal,* v. 36, Mar. 1957, p. 120s-130s.

Correlation of data to establish the parameters governing pressure-vessel design with respect to the plastic fatigue characteristics of the material. Testing methods have been evaluated for determining "plastic endurance" as a characteristic of the material itself, as well as methods for establishing the "effective strain concentration factor" of various plate surface conditions, notches, attachments and the effects of welding. 15 ref.
(Q7a, Q24h, T26q)

394-Q. (English.) **Internal Friction and Critical Stress of Copper Alloys.** Shuichiro Takahashi. *Physical Society of Japan, Journal,* v. 11, Dec. 1956, p. 1956-1261.

The effects of strain amplitude on the internal friction and the Young's modulus of polycrystalline specimens of copper alloys (copper-zinc, copper-aluminum, copper-phosphorus) with various concentrations of solute atoms. 10 ref.
(Q22, Q21a, 3-16; Cu, *Zn, Al, P*)

395-Q. (English.) **Improvement of Copper Alloy Springs—I. Effects of Various Third Elements Added to Plain 60-40 Brass.** Masaynki Kawasaki and Osamu Izumi. *Tohoku University, Science Reports of the Research Institutes,* v. 8A, Dec. 1956, p. 484-492.

To improve the spring properties of plain 60-40 brass, iron, aluminum, manganese, nickel, cadmium and tin were added to the alloy; the alloys of copper-manganese-nickel and copper-iron series were examined.
(Q5g, 2-10; Cu-n, SGA-b)

396-Q. (English.) **Improvement of Copper Alloy Springs—II. 60-40 Brass Series Containing Iron, Manganese and Tin.** Osamu Izumi and Masayuki Kawasaki. *Tohoku University, Science Reports of the Research Institutes,* v. 8A, Dec. 1956, p. 493-501.

Effects of the respective elements on spring properties and bending characteristics of 60-40 brass sheet compared with each other. Present results showed that manganese and tin would be the most favorable elements for practical purposes.
(Q5g; Cu-n, 2-10, SGA-b)

397-Q. (German.) **Creep of Aluminum Wires and Ropes.** S. Wintergerst and M. Aepfelbacher. *Aluminium,* v. 33, Jan. 1957, p. 16-23.

Creep tests on 99.5 aluminum wires and ropes under constant tension provide information about the dependence of creep in the elastic range and beyond on the stress. The effect of temperature variation between −6 and +66° C. The dependence of creep on structure and grain size of annealed wires and single crystals. 12 ref.
(Q3, 2-11, 3-21; Al, 4-11)

398-Q. (Italian.) **On the Formation of Chips.** Giuseppe Carro Cao. *Ingegneria Meccanica,* v. 5, Aug. 1956, p. 40-44.

Experimental confirmation of theory of plasticity as applied to problem of wedge penetrating a semi-infinite mass. Micrographic tests on continuous chip obtained from plastic material and cracked chip obtained from brittle material.
(Q24)

399-Q. (Italian.) **Theoretical and Technical Study of Plastic Flexure. Parts III and IV. Practical Results of the Theory.** *Ingegneria Meccanica,* v. 5, June 1956, p. 51-64.

Deals with sheet metal in general, mild steel in particular. This section deals with variations in thickness, initial position of central fiber and development of break under traction, shape of deformed material, moment and angle of bending, numerical values, effects of variations in length, progressivity of phenomena of plastic flexure. 8 ref.
(Q24, Q5g; CN, 4-3)

400-Q. (Japanese.) **Fatigue Rupture of Metals.** Masa Ishibashi. *Japan Society of Mechanical Engineers, Journal,* v. 60, Jan. 1957, p. 15-19.

Description of tensile test, slip rupture, fatigue process and fretting corrosion of light alloys. 83 ref.
(Q7a, Q27, R1f; EG-a39)

401-Q. (Spanish.) **Variation of the Properties of Spring Steels as Determined by Heat Treatment and Surface Finish.** Mario Pujol Roig. From "Papers Presented at 3rd General Assembly of the Iron and Steel Institute". 1956. 16 p.

First part is brief study of springs and spring steels, including characteristics, proper heat treatment, importance of surface condition and most common spring failures. Second part deals with experimental study of carbon spring steel. Gives characteristics of the steel, description of tests and results of various heat treatments, both conventional and isothermal, and of surface treatments; special attention to behavior under fatigue tests. Shows that treatment producing bainite is most favorable to fatigue life and that polishing and phosphating are more advisable than sandblasting. 11 ref.
(Q7a, 2-14; ST, SGA-b)

402-Q. Motion Pictures of Metal Fatigue. *ASTM Bulletin,* No. 220, Feb. 1957, p. 20.

Fatigue-testing machine equipped with a clock-controlled, 16-mm. camera to take time-lapse motion pictures of aluminum specimens under torsional stress has been constructed by National Bureau of Standards. (Q7, 1-3, X5; Al)

403-Q. New Method for Recording Explosion Impulse Effects on Solids. W. E. Bron, K. A. Zadwick and A. L. Tarr. *ASTM Bulletin,* No. 220, Feb. 1957, p. 50-51.

Method for measuring properties of elastic waves as propagated in metals and generated by explosives or other means, using strain gages, amplifiers and an oscilloscope for recording. Useful in experimenting with brittle failures. (Q21, 1-4)

404-Q. Stability of Mechanical Properties of Beta-Phase Magnesium-Lithium Alloys. W. R. D. Jones and G. V. Hogg. *Institute of Metals Journal,* v. 24, Feb. 1957, p. 255-261.

Attempts to decrease instability of mechanical properties by addition of varying amounts of silver, copper, cadmium, aluminum, tin, antimony or nickel to three basic beta-phase magnesium-lithium ternary alloys containing cadmium or zinc. Hardness, microscopic and X-ray diffraction studies suggested instability of mechanical properties is connected with electron concentration. Information on phase changes during aging. (Q general, N7a, 2-10; Mg, *Li*)

405-Q. Mechanical Properties of Flake Graphite Cast Irons. G. N. J. Gilbert. *Iron and Steel,* v. 30, Mar. 1957, p. 103-106.

Review of literature dealing with relationship of ratio of tensile strength to Brinell hardness with eutectic cell size and graphite type and size. Relationship between the tensile strength, hardness and modulus of elasticity and variation in effective cross section size with these. (Q27a, Q29n, Q21a, CI)

406-Q. Improving Hot Ductility of 310 Stainless. R. A. Perkins and W. O. Binder. *Journal of Metals,* v. 9, Feb. 1957, p. 239-245.

Factors which promote hot cracking tendencies. Effects of eight deoxidizing additions. Results cannot be applied directly to commercial practice; the observations should have general significance and applicability to the behavior of hot worked metal. 13 ref. (Q23p, 2-12; SS)

407-Q. Formation of Cracks in Soederberg Electrodes Used in Aluminum Reduction Plants. Ove Sandberg, Leif Olsen and Torgrim Eftestoel. *Journal of Metals,* v. 9, Feb. 1957, p. 261-266:

Research work performed to determine relationships between crack formation and shrinkage, method for measurement of shrinkage, raw material quality and paste composition as related to shrinkage phenomena. (Q26, W18, 17-7; Al)

408-Q. An Investigation of the Structural Conditions in Steel Bearing-Balls. I. Berz and C. Wainwright. *Metallurgia,* v. 55, Mar. 1957, p. 121-124.

Three nondestructive tests used for balls were tests for strength by rapidly rotating magnetic field, high-frequency electrical test and X-ray diffraction examination. Polar areas determined by X-ray examination were related to residual flow line markings of etched sections. Correlations found between X-ray results and measurements by high-frequency method. (Q27, 1-4; ST, SGA-c)

409-Q. Zinc-Aluminum-Copper Bearing Metal. Properties of Alzen 305 Alloy. *Metallurgia,* v. 55, Mar. 1957, p. 133-134.

Mechanical, seizure, wearing and casting properties of Alzen 305 and comparison to traditional phosphor bronzes. (Q general, Q9n, E25p, *Zn*. Al, Cu, SGA-c)

410-Q. Assessment of the Drawing and Forming Qualities of Sheet Metal by the Swift Cup-Forming Test. O. H. Kemmis. *Sheet Metal Industries,* v. 34, Mar. 1957, p. 203-208.

Reasons for use of tests. Test development. Investigation on the correlation of the test with pressing performance of sheet steel. Proposals for standardizing testing procedures. Information on test pieces, equipment and method. (To be concluded.) (Q23q, 1-4; ST, 4-3)

411-Q. Survey of Low-Alloy Aircraft Steels Heat Treated to High Strength Levels. (Pt. 3). Failure Causes. G. Sachs. Syracuse University (Wright Air Development Center). *U.S. Office of Technical Services,* PB 121667, July 1954, 80 p. $2.00.

Failure in high-strength steel aircraft parts stems from a number of different sources, it was concluded from data gained from descriptions of actual failures and analyses of conditions and sources of failures; in addition, failure usually resulted from a combination of several factors which deviated from those encountered in regular manufacture, rather than from a single factor. (Q general, T24; AY-n)

412-Q. New High Temperature Intermetallic Materials. (Pt. 4). Ronald Silverman. American Electro Metal Corp. (Wright Air Development Center). *U.S. Office of Technical Services,* PB 121232, Mar. 1956, 49 p. $1.25.

Excellent high-temperature creep resistance, but low impact resistance, is reported for Alloy 223 (chromium-molybdenum-silicon, 81-16-3). Materials with appreciable amounts of sigma in the cobalt-chromium-molybdenum system proved unsuitable for jet turbine blading. Alloys in the nickel-zirconium binary system showed promising oxidation resistance and ductility. (Q3m, Q6n; Cr, *Mo, Si,* 14-18, SGA-h)

413-Q. Creep Buckling of Integrally Stiffened Aluminum Alloy Panels. C. W. King. North American Aviation, Inc. (Wright Air Development Center). *U.S. Office of Technical Services,* PB 121466, May 1956, 70 p. $1.75.

The tests were conducted at constant bending moment and temperature and uninterrupted time until failure; time ranged from fractional hours to 200 hr.; results were shown compared to a temperature-time parameter previously proposed for tensile creep properties to indicate the similarities in stress-temperature-lifetime relationships for the different basic mechanisms of failure. (Q3c; Al)

414-Q. Research on Elevated Temperature Resistant Ceramic Structural Adhesives. R. M. Spriggs, H. G. Lefort and D. G. Bennett. University of Illinois (Wright Air Development Center). *U.S. Office of Technical Services,* PB 121659, Sept. 1956, 99 p. $2.50.

Ceramic structural adhesives were evaluated as bonding materials for stainless steel subjected to the high-temperatures characteristic of jet engines. Adhesives tested were ceramic-oxide, glassy bond coatings, cermets with sintered metal bonds, and air-setting, temperature-resistant silicates. Results were based primarily on shear strength tests at room temperature and from 600 to 1000° F. An adhesive of the ceramic oxide, glassy-bond type gave best results when used with 28 mesh stainless steel as a carrier. (Q2g, 2-12; NM-f, NM-d34, SS)

415-Q. Slip Damping of Press-Fit Joints Under Linearly Varying Pressure. J. H. Klump and L. E. Goodman. University of Minnesota. (Wright Air Development Center). *U.S. Office of Technical Services,* PB 121760, Sept. 1956, 47 p. $1.25.

Develops expressions for the damping and elastic properties of joints under a linearly varying clamping pressure. The predictions of the theory are compared with the results of controlled experiments. Correlation is made between the linear pressure joint and a uniform pressure joint which was investigated previously. (Q8, Q21; 7-6)

416-Q. Creep, Fracture, and Bending of Lead and Lead Alloy Cable Sheathing. Curtis W. Dollins and Cecil E. Betzer. *University of Illinois Bulletin,* v. 54, Nov. 1956, 44 p.

Tests covered principally long-time creep under steady tensile stresses up to 300 psi. at 110 and 150° F., time to fracture and ductility under steady tensile stresses of 400 to 1800 psi. at room temperature and 110° F., and life to fracture in slow bending to strains of 0.3 to 0.5%. 14 ref. (Q3m, Q27a, Q5g; Pb)

417-Q. Torsional Properties of Steels at High Rates of Strain. Paul G. Jones and Thomas J. Dolan. *University of Illinois Bulletin,* v. 54, Feb. 1957, 23 p.

Determination of the effects of strain rate, temperature, type of notch and size of specimen on four steels tested in torsion. Unnotched specimens were ¼ in. in diameter and the root diameters of notched specimens were 3/16 in. and 3/8 in. Two sharpnesses of notch were used giving ratios of notch radius to root diameter r/D, of 0.160 and 0.053. Three rates of torsional strain were obtained by using angular velocities of 0.5 rpm., 27 rpm. and 1300 rpm. for the flywheel which loaded the specimen. The tests were conducted at −100° F., room temperature, and 700° F. 23 ref. (Q1a, 1-4; ST)

418-Q. (French.) Characteristics of the Design of Light Alloy Structures. (Pt. 2). Jean Reinhold and Henri Hugonnet. *Revue de l'Aluminium,* no. 235, Sept. 1956, p. 841-848.

Mechanical principles underlying aluminum structural design such as shearing stress, critical buckling stress, failing stress, torsion, shape factors, frequency of vibration. Discusses the problems involved. (Concluded.) (Q general; Al, SGB-s)

419-Q. (French.) Riv-Clé Rivets and the Assembly of Sheets Accessible

From Only One Side. (Pt. 3). B. Adaridi. *Revue de l'Aluminium,* no. 236, Oct. 1956, p. 963-967.

Tests carried out on open flat-head Riv-Clé rivets to determine mechanical properties such as the average setting effort, shearing stress and the axial tension stress under which the head is torn off. The choice of the metal is discussed according to the material used for the rivets: mild steel, brass with 35% zinc, or light alloy of the A-SG class.
(Q27, Q2, K13n; CN, Cu-n, Al)

420-Q. (German.) **Investigations of Aluminum Magnesium Casting Alloys.** M. Kato and Y. Nakamura. *Aluminium,* v. 33, Mar. 1957, p. 152-162.

Good mechanical properties and corrosion resistance of aluminum-magnesium alloys. Study of the reaction of the melt with graphite, steel and cast iron of crucibles and with wet and dry sand molds. Influence of alloying elements and impurities on physical properties. Mitigation of detrimental effect of silicon and iron by addition of manganese. 12 ref.
(Q general, R general, E25; Al, *Mg*)

421-Q. (German.) **Statistical Comparison of Notch Toughness Values as Measured on Two Different Pendulum Impact Testing Machines.** Alexander Schepers and Frenz Rudolf Licht. *Stahl und Eisen,* v. 77, Feb. 21, 1957, p. 218-221.

Testing results on DVM-test bars cut from normalized plain steels Type C15 with 0.15% C and C60 with 0.62% C. Determination of the notch toughness on two different pendulum impact testing machines with a maximum strength of blow of 15 and 30 kgm. Investigation of the reliability of the differences found by statistical methods and their interpretation. 2 ref.
(Q6r; CN)

422-Q. (German.) **Mechanical Properties of Weld Joints on Steels Used in the Construction of Boilers and Containers, as Dependent on the Heat Treatment.** Werner Hummitzsch. *Stahl und Eisen,* v. 77, Mar. 7, 1957, p. 279-290.

Mechanical properties of weld joints made by using different electrodes on boiler plates according to DIN 17-155 in the cold or hot worked conditions as well as in the undeformed condition after normalizing or stress relieving; similar investigations on special steels used in the construction of high-pressure containers and pipe-lines, as dependent on the cooling rate after welding; contents, partial pressures and equilibrium temperatures of hydrogen in the weld metal deposited by electrodes with acid ore or rutile coats or with a basic lime coat; effect of the hydrogen on the formation of cold cracks and fish-eyes during the tensile test and their suppression by using a special heat treatment of the weld seams.
(Q general, W29, ST, 7-1)

423-Q. (Book.) **Elevated Temperature Properties of Coppers and Copper-Base Alloys.** Fred F. Van Atta. American Society for Testing Materials, ASTM Special Technical Publication STP 181, Aug. 22, 1956, 248 p. $5.50.

A graphical summary of the elevated temperature data for coppers and copper-base alloys. Data for the coppers are limited to the wrought materials, while the data for the alloys apply to cast and wrought materials. Graphical data includes modulus of elasticity, tensile strength, yield strength (0.5% extension and 0.2% offset) reduction of area, elongation, stress for creep rates of 0.000001, 0.00001, and 0.0001% per hr. and stresses for rupture in 100, 1000, 10,000, and 100,000 hr.
(Q21a, Q27a, Q3m, 2-12; Cu)

R Corrosion

140-R. Dissolution of the Oxide Film on Zirconium. R. D. Misch. *Acta Metallurgica,* v. 5, Mar. 1957, p. 179-180. (CMA)

The rate of dissolution of the oxide film on zirconium when heated in vacuum was measured by comparing colors of anodic films before and after heating. Color changes were uniform and could be estimated to 90° A.; a uniform reduction at the metal:oxide interface is indicated. A graph shows that the rate of film dissolution varies linearly with tempearture over the range from 425 to 625° C. (R2r, 1-23; Zr)

141-R. Corrosion Problems in Chemical Factories—I. Choice of Construction Materials. F. R. Himsworth and J. G. Hines. *Chemical Age,* v. 77, Feb. 1957, p. 285-289.

Current practice in corrosion prevention. (R general, T28, 17-7)

142-R. Corrosion of Steel Pipe by Savannah River Water. F. Welty. E. I. du Pont de Nemours and Co. *U.S. Atomic Energy Commission,* D-170, Aug. 1956, 15 p.

Test sections of carbon steel pipe were pitted to a maximum depth of 0.06 in. during 30 months exposure to flow of raw river water. The rate of pitting penetration of new pipe decreased with time during the first year of exposure and thereafter leveled off at approximately 0.01 in. per year. (R4a; ST, 4-10)

143-R. Corrosion and Mass Transfer by Lithium at Elevated Temperatures. E. E. Hoffman and L. R. Trotter. "Metallurgy Information Meeting, Ames Laboratory", *U.S. Atomic Energy Commission,* TID-7526 (Pt. 1), Feb. 1957, p. 244-249.

Application of lithium metal as a heat transfer medium, especially as a nuclear reactor coolant. The major problem encountered, and one which is yet to be resolved, is the inability of commercially available metals and alloys to withstand the corrosive effect of lithium in dynamic systems at temperatures in excess of 1000° F. General review of the results of static, isothermal tests; recent results on 17 thermal convection loop tests conducted on iron and nickel-base alloys.
(R6m, 2-12, T11p; Li, Fe, Ni)

144-R. (German.) **Investigations of the Reaction Between Aluminum and Water.** D. Altenpohl. *Aluminium,* v. 33, Feb. 1957, p. 78-91.

The effect of repeated use of high-purity water, the influence of various small additions (e.g., silica, sulphuric acid, citric acid, boric and carbonic acids) thereto; influence of its pH and the suitability of layers formed in alkaline solution for corrosion protection. 11 ref.
(R4, 1-2; Al)

145-R. (German.) **Behavior of Some Aluminum Alloys in Mixtures of Chromic and Phosphoric Acids.** K. M. Carlsen. *Aluminium,* v. 33, Feb. 1957, p. 101-103.

Hot 4% chromic anhydride and 10% phosphoric acid used, in the removal of corrosion from aluminum, itself attacks aluminum and aluminum alloys under normal conditions. 2 ref. (R6g; Al)

146-R. (Swedish.) **Stress-Corrosion in Aluminium Alloys.** *Teknisk Tidskrift,* v. 86, Nov. 13, 1956, p. 983-985.

Causes, detection and mechanism of stress-corrosion. The best protection is plating with pure aluminum. (R1d; Al)

147-R. New Data on Stress-Corrosion Cracking of Brass. *ASTM Bulletin,* No. 220, Feb. 1957, p. 37.

Study of the relationship between crystal orientation and stress-corrosion cracking in alpha and beta brasses. Results indicate crystal orientation has an important influence on galvanic action which produces cracking. (R1d; Cu-n)

148-R. Variations in the Structure Across the Thickness of the Scale on Nickel Steels. K. Sachs. *Iron and Steel Institute Journal,* v. 185, Mar. 1957, p. 348-357.

The inner layers of the scales formed by various treatments on specimens of nickel steel were examined by a number of different methods. It was found that both the amount of metal in the scale and the over-all nickel content pass through a maximum at some distance from the metal core; no nickel was found outside the dimensions of the original specimens, except in one case. The scale near the core consists of wüstite and metal enriched in nickel. 13 ref.
(R2q, M27; AY, *Ni*)

149-R. Measurement of the Corrosion Rate of Iron by Polarization Techniques. W. J. Schwerdtfeger. *Journal of Research of the National Bureau of Standards,* v. 58, Mar. 1957, p. 145-153.

Corrosion-rate measurements can be made automatically by using a synchronously driven voltage divider and a two-pen electronic recorder. The polarizing characteristics of high-silicon cast iron when exposed to a 2,000-ppm. sodium chloride solution were also studied. It is shown that the corrosion rate becomes relatively low as the corrosion reaction changes from cathodic to anodic control. 8 ref. (R11m; Fe)

150-R. Influence of Crystallographic Orientation on the Corrosion Rate of Aluminum in Acids and Alkalies. Theodore H. Orem. *Journal of Research of the National Bureau of Standards,* v. 58, Mar. 1957, p. 157-167.

The corrosion of single crystals of high-purity aluminum in strong acid and alkali media is disclosed as an orderly process, the rate of attack being dependent on the orientation of the corroding surface; observations of the corrosion by acid and alkali solutions of disks with central holes, and rectangular prisms, both of monocrystalline aluminum, result in interesting conclusions and comparisons with respect to the corrosion process. 15 ref.
(R6g, R6j, 3-22; Al)

151-R. Current Views on How Paint Films Prevent Corrosion. J. E. O. Mayne. *Oil and Colour Chemists'*

Association, Journal, v. 40, Mar. 1957, p. 183-199.

Mechanism of the corrosion of iron and steel and the arguments which led to the conclusion that protection is associated with a high electrical resistance; the effect of ions on this resistance is considered. The ions may be underneath the paint film and consequently short-circuit the high resistance, or they may occur outside the film and bring about a decrease in resistance by diffusing into the film. (R1; 8-20)

152-R. (German.) **Corrosion of Soft Steel in Alkali Mono and Alkali Hydrogen Fluorides. 1. Influence of the Concentration of the Solution Upon the Corrosion of Soft Steel.** W. Köhler. *Werkstoffe und Korrosion,* v. 8, Mar. 1957, p. 133-138.

Corrosion depends on concentration of the solution. In potassium fluoride and potassium fluoride-hydrogen fluoride solutions corrosion resistant coatings are formed, while in ammonium fluoride-hydrogen fluoride solutions corrosion appears even at relatively high concentrations. 16 ref. (R6j; CN)

153-R. (German.) **On the Behavior of Brass in Dilute Solutions of Mineral Acids and Their Mixtures in the Presence as Well as in the Absence of Inhibitors.** W. Machu and M. G. Fouad. *Werkstoffe und Korrosion,* v. 8, Mar. 1957, p. 139-145.

Loss of weight of 60-40 brass in mineral acids or their mixtures, with and without inhibitors, is not additive and does not depend on the accelerating or inhibiting effects of the inhibitors, but on the more or less favorable conditions which prevail for the formation of protective coatings. 15 ref.
(R6g, R10b; Cu-n)

154-R. (Spanish.) **Tests on Susceptibility to Intercrystalline Corrosion in 18-8 Stainless Steels.** Francisco Joanxich Ayma. From "Papers Presented at 28th International Congress of Industrial Chemistry", 1956, 5 p.

Standard A.S.T.M. tests and metallographic tests performed on four specimens of steel (one of Spanish origin and three foreign); results compared. Metallographic tests were accurate; their brevity makes them highly practical. 21 ref.
(R11a, 15-18)

155-R. (Book.) **Corrosion: A Compilation.** Mars G. Fontana. 280 p. 1957. Press of Hollenback, Columbus, Ohio.

Practically all metals and alloys and some nonmetallics used for corrosion applications are covered. Methods and detailed procedures for laboratory and plant testing. Iso-corrosion charts, which show corrosion as a function of temperature and concentration of acids. Causes and cures for many actual plant problems. Mechanisms of corrosion are described in readily understandable terms. (R general)

Inspection and Control

157-S. Use of Ion Exchange Resins for Determination of Uranium in Ores and Solutions. Sallie Fisher and Robert Kunin. *Analytical Chemistry,* v. 29, Mar. 1957, p. 400-402.

The separation of uranium from the ions interfering with its analysis is accomplished by the adsorption of the uranium sulphate complex on a quaternary ammonium anion exchange resin. Interference of such ions as iron and vanadium is avoided by their preferential reduction with sulphurous acid so that they are not retained by the resin. The method is applicable to both solutions and ores. (S11f; U)

158-S. The Mutual Separation of Thorium, Protoactinium, and Uranium by Tributyl Phosphate Extraction From Hydrochloric Acid. D. F. Peppard, G. W. Mason and M. V. Gergel. *Inorganic and Nuclear Chemistry, Journal,* v. 3, Jan. 1957, p. 370-378.

The distribution behavior of uranium (VI) and protoactinium (V) in the system aqueous hydrochloric acid—TBP (tributyl phosphate) without diluent has been investigated at 22 ±2° C. and the results compared with those reported for thorium in the system. (S11f; Th, Pa, U)

159-S. Separation of Thorium and Uranium Nitrates by Anion Exchange. D. J. Carswell. *Inorganic and Nuclear Chemistry, Journal,* v. 3, Jan. 1957, p. 384-387.

The anionic character of thorium in nitric acid solutions was investigated and distribution coefficients measured. The results were employed to effect a separation of thorium and uranium by anion exchange. (S11f; Th, U)

160-S. (English.) **Studies on the Flame Spectrochemical Analysis. VII. Determination of Chromium.** Shigero Ikeda. *Tohoku University, Science Reports of the Research Institutes,* v. 8A, Dec. 1956, p. 463-470.

Chromium radiated its spectral line at 359.0, 455.0, 427.5, 428.9 and 520 millimicrons, and the spectrum was most intense at 425.0 and next at 427.5 millimicrons. Alkali metal increased the intensity appreciably, while alkali earth metal depressed the emission remarkedly when their concentration became large. Chromium in iron-chromium alloy and slags was determined.
(S11k; Fe, *Cr,* RM-q)

161-S. Nondestructive Testing of EBWR Fuel Blates. W. J. McGonnagle and W. N. Beck. Paper from "Metallurgical Information Meeting, Ames Laboratory", May 1956. *U.S. Atomic Energy Commission,* TID-7526 (Pt. 1), Feb. 1957, p. 1-15.

The following nondestructive testing methods are used for inspecting the EBWR fuel elements; radiography, autoradiography and ultrasonic transmission. A radiographic technique is used to show the location of the core with respect to the end and side clad. The ultransonic transmission technique is used to test for lack of bonding between the core and clad material and for locating blowholes, porosity and pipe in the core billets. (S13e, S13g, T11g)

162-S. Radioanalysis of Krypton and Xenon and Its Use in Diffusion Experiments With Silver. J. Martin Tobin. Paper from "Metallurgical Information Meeting, Ames Laboratory", May 1956. *U.S. Atomic Energy Commision,* TID-7526 (Pt. 1), Feb. 1957, p. 129-149.

A method has been evaluated which is capable of analyzing relative concentrations of krypton and xenon gases whose total concentration is in the range of 10^{-10} to 10^{-8} gram-atoms. The necessary gas collection and gas transfer apparatus is described. (S11q, 1-3; Kr, Xe)

163-S. Inspection of Small Diameter Tubing by Eddy Current Methods. J. W. Allen and R. B. Oliver. Paper from "Metallurgical Information Meeting, Ames Laboratory", May 1956, *U.S. Atomic Energy Commission,* TID-7526 (Pt. 1), Feb. 1957, p. 209-226.

Basic principles of eddy current testing as they apply to the problem of inspecting small-diameter tubing. Both encircling coils and probe coils are considered and the relative advantages of each presented. The inspection problem is described in terms of separation and classification of defect types rather than in terms of mere sensitivity to defects. As a possible means of defining defect types the "impedance analysis" concept introduced by Forster is examined in detail.
(S11h; 4-10)

164-S. Application of the Immersed Ultrasonic Technique for the Inspection of Small Diameter Tubes. R. B. Oliver and R. W. McClung. Paper from "Metallurgical Information Meeting, Ames Laboratory", May 1956. *U.S. Atomic Energy Commission,* TID-7526 (Pt. 1), Feb. 1957, p. 227-243.

The criteria for the selection of equipment to inspect tube sizes less than ½ in. in diameter are presented and the testing procedure described. Collimation of the ultrasound beam and the mode of sound propagation are discussed. Capabilities and limitations of this inspection method and typical defects detected. (S13g; 4-10)

165-S. Greater Acceptance of Welding Through the Use of Inspection Methods. John R. Harrer. *Welding Journal,* v. 36, Mar. 1957, p. 252-256.

Magnetic-particle inspection on weldments which are critical from the standpoint of serviceability, strength and alignment. Necessity of establishing adequate standards for such inspection. (S13j; 7-1)

166-S. (French.) **Statistical Methods of Analyzing the Results of Fatigue Tests Conducted on Materials Used in Aircraft Construction.** F. Gatto. *Metaux-Corrosion-Industries,* v. 32, Jan. 1957, p. 18-37.

Principal statistical methods of analyzing fatigue data, including probit analysis and the staircase method, with special reference to light alloys employed in the aircraft industry. 30 ref. (S12, Q7k; EG-a39)

167-S. (German.) **High-Speed Analysis of Magnesium in Iron.** R. Reichert. *Giesserei,* v. 44, Jan. 17, 1957, p. 51-52.

Different methods of determining magnesium. Titration according to G. Schwarzenbach and W. Biedermann. Description of the working method. 7 ref. (S11j; Fe, *Mg*)

168-S. (German.) **Full-Automatic Control of Modern Pit Furnaces.** Karl Rieder. *Stahl und Eisen,* v. 77, Feb. 7, 1957, p. 157-162.

Temperature control by "Siamco" system for pit furnaces; thermotechnical comparison with the previous method of electrical control.
(S16r, W20)

169-S. (Italian.) **Comparative Interferometric Measurements.** Alfredo Secciani. *Macchine,* v. 12, Jan. 1957, p. 1-10.

System based on interpretation of fringes of interference produced on surface of a prefectly plane glass disk when placed at an angle on a metal surface permits qualitative and quantitative interpretation of all interferometric phenomena. Physical concepts of system; principal

applications in measurement of errors of planarity, external dimensions of cylindrical and spherical prismatic solids, errors of parallelism of plane surfaces. Numerous examples given. (S15d)

170-S. (Japanese.) **Rapid Determination of Lime in the Slags of Blast Furnaces and Openhearth Furnaces by Ethylenediaminetraacetate Titration.** Shizo Hirano and Moriji Kurobe. *Japan Analyst,* v. 5, Dec. 1956, p. 680-684.

Procedures given. Time required for a test is about 10 min. 10 ref. (S11j; RM-q)

171-S. (Japanese.) **A Rapid Flame Photometric Determination of a Microquantity of Sodium in Lead.** Shanzow Fukushima Shiro Iwatta, Sanshiro Kume and Misako Shigemoto. *Japan Analyst,* v. 5, Dec. 1956, p. 704-707.

Determination of about 0.002% sodium in lead by flame photometric determination requires two days. A rapid method of determination based on the addition standard, linear extrapolation method, carried out without removing the coexisting substances, is described. (S11k; Pb, *Na*)

172-S. (Japanese.) **Rapid Volumetric Determination of Vanadium.** S. Wakamatsu. *Japan Analyst,* v. 6, Jan. 1957, p. 19-22. (CMA)

Vanadium may be quickly determined volumetrically, based on permanganometry of the V(IV) ion. The method is applicable to the analysis of steel and ferrovanadium. Iron in excess does not interfere if oxidized to the ferric state by ammonium persulphate. Sulphuric acid and H_3PO_4 are used to digest the sample. V(VI) is stable regarding valency in hot, white, fuming H_2SO_4. (S11j; ST, AD-n, *V*)

173-S. (Spanish.) **Nondestructive Tests as an Economical Means of Inspecting Welding Production.** A. Junghem and K. E. Gredborn. *Ciencia y Tecnica de la Soldadura,* v. 6, Nov.-Dec. 1956. 8 p.

Possibilities and applications of radiographic and ultrasonic tests. (S13e, S13g; 7-1)

174-S. For the Foundry. Temperature at a Glance. *Canadian Metals,* v. 20, Mar. 1957, p. 60-61.

Low-cost immersion thermocouple with recorder enables quick temperature checks. (S16, 1-2)

175-S. Instrumentation for Temperature Control Guides Continuous Steel Casting. *Industrial Heating,* v. 24, Mar. 1957, p. 523-528 and 644.

Instrumentation provides measurements of molten metal temperature, control of ladle tilt, regulation of machine speed, cooling water temperature and slab surface temperatures. (S16, S18, 1-2, D9q; ST)

176-S. Role of Statistical Methods in Controlling the Quality of Non-Ferrous Castings. A. R. Martin. *Institute of Metals Journal,* v. 24, Feb. 1957, p. 209-226.

Statistical methods of process control suitable for foundry purposes. Conventional ways of presenting and treating test data. Illustrates through work examples selection of appropriate statistical approach and results to be expected from its application. (S12, E general)

177-S. Standardization and Application of Ultrasonic Surface-Wave Inspection. George J. Binczewski. *Nondestructive Testing,* v. 15, Jan.-Feb. 1957, p. 36-40.

Application of ultrasonic surface waves as a method for inspecting metal affords a reliable and economical procedure for detecting cracks, seams, inclusions, laps, segregates and porosity. Surface conditions that influence propagation of surface waves and response of waves as affected by distance, depth and edge angles of surface imperfections are reported. Applications are discussed, including surface-cracking on aluminum plate during fabrication. (S13g)

178-S. (Italian.) **Methods of Inspecting Anodic Oxide on Aluminum.** Engineering Staff of Experimental Institute for Light Metals, Novara, Italy. *Alluminio,* v. 26, Jan. 1957, p. 29-34.

Methods used to evaluate thickness, porosity, electrical insulation capacity, and resistance to light, abrasion and corrosion. 10 ref. (S14, S15, Q9n, R general; Al, 8-23)

179-S. (Book.) **Organic Reagents for Metals.** W. C. Johnson, Ed. 199 p. 1955. Chemical Publishing Co., Inc., 212 Fifth Ave., New York 10, N. Y. $4.00.

Reagents covered are either new or older ones for which new methods of application were found and some were designed to solve special problems; in discussing these reagents, a critical approach was used and practical details were carefully checked. (S11; NM-b)

180-S. (Book—French.) **Digest of Magnetic Particle Inspection. Testing of Materials by the Magnetic Powder Method.** E. A. W. Muller. 169 p. 1957. Dunod, 92, Rue Bonaparte, Paris 6, France.

Use of magnetic powders in flaw detection; review of significant works published; fundamental principles underlying the process; principal industrial applications; methods and apparatus employed; production economies resulting from use of this process. Contains also a bibliography of 151 items. (S13j)

Metal Products and Parts

97-T. High Speed Structures Keyed to Materials. Irving Stone. *Aviation Week,* v. 66, Feb. 25, 1957, p. 80-89.

Structures for high-speed aircraft and missiles are closely keyed to basic design and the critical variables of materials in relation to high temperatures. One major question is how extensively titanium alloy is going to fit changing structural requirements. Hot-forming properties of titanium alloy and tolerance control are discussed. (T24, T2; Ti)

98-T. Work-Hardened Twisted Reinforcing Steel. Kurt Billig. *Civil Engineering,* v. 52, Feb. 1957, p. 173-175.

Design and construction of reinforced concrete from the aspects of aging, bond strength and welding properties of the steel bars. 12 ref. (T26, Q general, K9s; ST)

99-T. Aluminum Radiators. *SAE Journal,* Mar. 1957, p. 50-52.

List of characteristics of solders for brass-tube, aluminum-fin assemblies and the results of field service tests of aluminum radiators. Costs for mass production also discussed. (T21b; Al, SGA-f)

100-T. Exploring the Thermal Barrier. *Steel,* Mar. 11, 1957, v. 140, p. 154-158.

Suitability of metals for use in future aircraft. Tensile strength at high temperatures of many present and prospective commercial stainless steels, hot work die steels, titanium alloys and high-temperature alloys. (T24, Q27a, 2-12; SS, TS-k, Ti, SGA-h)

101-T. Aircraft Gas Turbines Ten Years From Now. R. B. Johnson, Jr. *Steel,* v. 140, Mar. 18, 1957, p. 108-109.

Outlines developments necessary in high-temperature alloys for engine components, heat resisting coatings and ceramic materials to meet increasing engine temperatures over next decade. (T24b; SGA-h)

102-T. (Swedish.) **Beryllium Copper—a Superior Material for Pressing and Molding Tools.** Peter G. Lindberg. *Industritidningen Norden,* v. 84, Oct. 31, 1956, p. 304, 308.

Beryllium-copper used in tools for work with plastics and new metals and alloys, such as polystyrene, nylon, ethylcellulose, light metal, stainless steel, titanium and zinc. (T6; Be, Cu)

103-T. Boron Compounds for Nuclear Applications. Gordon R. Finlay. *American Ceramic Society Bulletin,* v. 36, Mar. 1957, p. 109-111.

Development, production and application of the boron isotope, B^{10}, elemental boron, boron carbide and boron nitride are reviewed. 16 ref. (T11; B)

104-T. Dyed Anodic Finishes in Architecture. A. W. Brace. *Light Metals,* v. 20, Feb. 1957, p. 61-64.

Discussion of installations in various countries, durability, maintenance, choice of materials and light fastness. Gray, gold, and bronze are the only permanent colors, while blue, yellow, green and black have sufficient permanency for 5-10 years. 8 ref. (T26n; Al, 8-23)

105-T. New Refractories. J. Lomas. *Machinery Lloyd,* v. 29, Feb. 16, 1957, p. 91-92.

Borides, hydrides, nitrides, silicides, cermets, molybdenum alloys, titanium alloys and chromium alloys as materials for turbine blades. (T7; Mo, Ti, Cr, 14-18, SGA-h)

106-T. Canadian Railroads Get Aluminum Freight Cars Rolling. *Modern Metals,* v. 13, Mar. 1957, p. 56-64.

Service tests confirmed ability of aluminum boxcars, hopper cars, and reefers to withstand abuse and combine advantages of light weight, corrosion resistance and low maintenance. (T23p; Al)

107-T. England's Head Wrightson Builds Big in Aluminum. R. B. W. Bolland. *Modern Metals,* v. 13, Mar. 1957, p. 76-84.

British firm applies new design concepts to large aluminum structures such as bridges, traveling cranes, roof trusses, hangar doors, and crane jibs. (T26, 17-1; Al)

108-T. Use of Aluminium Honeycomb Sandwich Construction for Commercial and Aircraft Applications. G. S. Newell. *Sheet Metal Industries,* v. 34, Mar. 1957, p. 197-202.

Production of honeycomb, mechanical properties, typical aircraft applications and possible commercial uses and design consideration. Bonding and fastening of honeycomb. (T24, K13; Al, 7-9)

109-T. (French.) **Comprehensive View of Aluminum in Electricity.** Pierre

Jacomet. *Revue de l'Aluminium*, no. 235, Sept. 1956, p. 833-837.

Excellent physical and chemical properties of aluminum have resulted in the extension of its use in the various fields of electrical equipment and construction permitting considerable economies. Cites examples of applications. (T1; Al)

W Plant Equipment

116-W. Modernized Plant Adopts Mechanized Heat Treating. Francis A. O'Brien. *American Machinist*, v. 101, Mar. 11, 1957, p. 146-147.

Snap-hearth furnace with controlled atmosphere and washer-dryer combination can carbo-nitride and clean to control case depth of 300 lb. of screws per hr.
(W27, 18-24, J28m; ST)

117-W. Electric Power Systems for Steel Plants. H. N. Cox and L. G. Levoy. *Applications and Steel Industry, (A.I.E.E. Transactions)*, no. 28, Jan. 1957, p. 339-348.

Progress in electric systems and components in steelmaking industry; electric energy generation and consumption, general requirements of steel mill power systems. (W11; ST)

118-W. Compressed Air Essentials in Steel Plant Operations. *Blast Furnace and Steel Plant*, v. 45, Mar. 1957, p. 326-328 and 344.

Includes uses of compressor selection and installation, distribution systems, operation and maintenance. (W13; ST)

119-W. Titanium Condenser Tubes. *Engineering and Boiler House Review*, v. 72, Mar. 1957, p. 75-76. (CMA)

The first titanium condenser tubes ever used in a British power station are undergoing service at Uskmouth Power Station (South Wales), located on the Usk estuary. The tubes are solid-drawn from ICI Titanium 130. The ICI nomenclature is described. Titanium has excellent corrosion resistance to sea water.
(W11, 17-7, R4b; Ti)

120-W. Let Magnets Clean Up Rolling Mill Coolants. A. L. Wilson, Jr. *Iron Age*, v. 179, Mar. 7, 1957, p. 132-133.

Drum-type magnetic separators effectively remove magnetic contaminants and oil waste from dirty cold rolling mill coolants, greatly prolonging interval between tank clean-outs.
(W23; NM-h)

121-W. Fuel and Power Balance in Ironworks; Influence of New Trends in Ironmaking. J. Szceniowski. *Iron and Coal Trades Review*, v. 174, Feb. 15, 1957, p. 385-388.

Iron and steelworks using a high propertion of molten iron have been considered as excessive producers of gas and power. The construction of "common-houses" made it possible to utilize the gas surplus more profitably from the viewpoint of heat balance of blast furnace.
(W17, D1; Fe)

122-W. Forging Furnaces in Sweden. A. Roslund and E. Tholander. *Metal Treatment and Drop Forging*, v. 24, Feb. 1957, p. 47-53.

Oil heated and electric furnaces for forgings discussed with reference to furnace design, atmosphere and temperature control, mechanization of handling, and relative economies with relation to fuel supply in Sweden. (W20; RM-k30, 16-11)

123-W. Drop-Forging Dies and Tools. M. J. Husson. *Metal Treatment and Drop Forging*, v. 24, Feb. 1957, p. 61-64, 68.

Considerations in design and treatment of dies for both old and new drop hammers. Operations in production of forgings. Die-block materials and die manufacture as practiced in France. (W22, 17-7, 17-1)

124-W. A Comparative Study of Thoriated, Zirconiated and Pure Tungsten Electrodes. L. P. Winsor and R. R. Turk. *Welding Journal*, v. 36, Mar. 1957, p. 113s-119s.

Comparison was made under both normal and abnormal welding conditions using direct current and alternating current arcs in atmospheres of argon and helium. Thoriated-tungsten electrodes showed superior starting performance during d-c straight polarity welding of stainless steel, followed by zirconiated tungsten and pure tungsten in that order. 4 ref.
(W29, 17-7; SS, W)

125-W. (German.) The Hand Scraper in the Foundry. W. Gesell and W. Riege. *Giesserei*, v. 44, Feb. 14, 1957, p. 107-110.

Various types of scrapers. Possible uses. Special combinations with other loading or handling means.
(W19, W12)

126-W. (German.) Investigation on the Behavior of Feeders, Williams Type, as Down-Gates for Steel Castings. Heinz-Ulrich Doliwa. *Giesserei*, v. 44, Feb. 28, 1957, p. 129-133.

Principles of the feeding technique; advantages and disadvantages of Williams feeders; conditions for the combination of Williams feeders and open gates at atmospheric pressure. (W19, E22p; ST, 5)

127-W. (German.) New Cast Iron Materials for Rolls. Their Characteristics and Possibilities of Application. Helmut Goebel. *Stahl und Eisen*, v. 77, Feb. 7, 1957, p. 143-157.

Importance of the modern developments in rolling methods; requirements to be met by the materials used for rolls. Cast iron with spheroidal graphite as compared with chilled cast iron; mechanical properties of the materials.
(W23, Q general; CI, 17-7)

128-W. (Italian.) Metallurgical Problems of Nuclear Reactors. F. Giordani. *Metallurgia Italiana*, v. 49, Jan. 1957, p. 1-13.

Fusion, fission, lixiviation, sintering, etc., of uranium, thorium, plutonium; methods of obtaining enriched nuclear fuels; treatment of exhausted nuclear fuels; heterogeneous thermal reactors; problems of temperature and corrosion; radiation; etc. (W11, 17-7; U, Th, Pu)

129-W. Dry Hearth Melting for Aluminum. F. L. Turk. *Canadian Metals*, v. 20, Mar. 1957, p. 24.

Sloping hearth furnace used by blower manufacturer has faster melting rate, continuous feed to holding bath and constant holding temperature. (W18; Al)

130-W. Carbon-Dioxide Process of Mould and Core Production. G. E. Parramore. *Foundry Trade Journal*, v. 102, Mar. 1957, p. 325-331.

Development, equipment, gassing technique, preparation and storing of sand and binder in mold and core production using carbon dioxide to harden sodium silicate binder in sand. Discusses variety of mold and castings, demonstrating versatility, merits and limitations of method. (To be continued.) (W19; NM-f45)

131-W. New 60-Cycle Aluminum Billet Heater for Continuous Extrusion Process. D. G. Hatchard, P. G. Simpson and L. B. Kimbrough. *Industrial Heating*, v. 24, Feb. 1957, p. 295-302.

Heat control operation and advantages of induction heater.
(W20, F24, 1-11; Al)

132-W. Carbon Arc Image Furnace. T. P. Davis. *Industrial Heating*, v. 24, Mar. 1957, p. 496-504.

Three systems for gathering and concentrating irradiance; methods for controlling and measuring radiant energy; advantages and limitations of heating methods. (W27)

133-W. All-Basic Open Hearth Furnace. R. P. Heuer and M. A. Fay. *Iron and Steel Engineer*, v. 34, Feb. 1957, p. 95-118.

Development of all-basic furnaces in America and Europe, construction and operation. Productivity and cost compared to furnaces with silica main roofs. 137 ref.
(W18; RM-h38)

134-W. Electrical Equipment for Continuous Annealing of Silicon Steel Strip. G. J. Hay and H. S. Fegely. *Iron and Steel Engineer*, v. 34, Mar. 1957, p. 78-85.

An all-magnetic amplifier regulating system (with the exception of loop control) is in successful operation on a major processing line; the design enables factory assembly and adjustment in the factory prior to startup and provides increased reliability and reduced maintenance.
(W27, X10, J23, 1-11; ST, 84, 4-3)

135-W. Stone Pit Lining Experience at Ford. William J. Scharfenaker. *Iron and Steel Engineer*, v. 34, Mar. 1957, p. 98-104.

Application of sandstone pit lining and its advantages and disadvantages. Stone has its place in soaking pits but it must be used with judgment; considerable care is required in construction and operation, particularly on pits with long walls. (W20; RM-h)

136-W. Cooperative Trials on All-Basic Furnace Roofs. B.I.S.R.A. and British Ceramic Research Association. *Iron and Steel Institute Journal*, v. 185, Mar. 1957, p. 304-328.

All-basic openhearth roof trials at four steel plants are described. Seven of the eleven trials were panel roofs of either Detrick or Continental suspension. The panel roofs were built with either four or five transverse panels of two or three brick brands so that at least two brands of bricks of different chemical and physical properties could be compared under the same conditions in one roof. (W18; RM-h)

137-W. Graphite Electrode Consumption in Electric Arc Furnaces. T. A. Cosh. *Iron and Steel Institute Journal*, v. 185, Mar. 1957, p. 328-332.

Data relating to electrode consumption in production-type electric-arc furnaces have been subjected to statistical analysis. From an analysis of these data indications are given of the extent to which electrode length, diameter, and surface area influence electrode con-

sumption. The effect of electrode diameter on electrical consumption has also been analyzed. (W18, S12)

138-W. Templeborough Melting Shop Reconstruction Scheme. F. Moore. *Iron and Steel Institute Journal*, v. 185, Mar. 1957, p. 333-342.

Fourteen openhearth furnaces of 80 tons capacity were each converted to 100 tons capacity. This involved a complete change of the structures and equipment needed for casting. The ways in which the changes were made to minimize production losses are described. (W18, 18-19, D2)

139-W. Use of Oxygen at Abbey Melting Shop, Steel Co. of Wales, Ltd. A. J. Kesterton. *Journal of Metals*, v. 9, Feb. 1957, p. 274-280.

Description of a water-cooled probe, introduced through the roof of an openhearth furnace for jetting oxygen into steel. Effects on carbon elimination and other operating data. A system of slag control for sulphur elimination, involving control of oxygen utilization, lime addition and bath carbon. (W18, D2g)

140-W. Nonferrous Research Uses Solar Furnace. W. M. Tuddenham. *Journal of Metals*, v. 9, Mar. 1957, p. 346-348.

Description of solar energy furnace built at Kennecott utilizing 60-in. searchlight reflector and heliostat. (W13, 16-13)

141-W. (German.) **Special Machine for the Milling of Light Metal Bars.** A. Pfeifer. *Aluminium*, v. 33, Mar. 1957, p. 164-170.

Nearly automatic machine for the milling of rolled bars and detecting cracks. Description of individual parts (connecting track, loading station, chucking and milling station, testing and unloading station). Processing of a pure aluminum bar (60 x 33½ x 9") in 2 min. (20 metric tons of bars per hr.). (W25; A1)

142-W. (German.) **Progress in the Development of Welding Rods Coated With Titanium Oxide.** Camille De Rop. *Stahl und Eisen*, v. 77, Feb. 21, 1957, p. 215-218. (CMA)

The rod described is thickly covered with a mixture of metal oxides containing up to 50% titanium dioxide, mostly as rutile. During the welding operation a fluid but easily solidifying slag is formed, permitting welding speeds up to 50 cm. per min. in horizontal work. The resulting weld is metallurgically pure and of satisfactory mechanical properties, even at high welding speeds. 9 ref. (W29, K1)

143-W. (Italian.) **Liquid Parting Agents for Forms.** Rinaldo Cattaneo. *Fonderie*, v. 6, Jan. 1957, p. 27-28.

Disadvantages of classic parting agents. Liquid agents can be used for as many as 15 to 20 castings per application. Characteristics of good liquid agents; method of use. (W19)

144-W. (Italian.) **Contribution to the Study of Behavior of Silica Bricks in Electric Furnace Vaults.** E. Biagiotti and G. Grungo. *Metallurgia Italiana*, v. 49, Jan. 1957, p. 35-43.

Examination of "nontransformed" and "transformed" types of bricks in zones of several vaults of the same electric furnace used under possibly different conditions. Importance of microscopic study underlined. (W18; RM-h 36)

145-W. (Book.) **Commercial and International Developments in Atomic Energy.** 598 p. 1956. Atomic Industrial Forum, Inc. 260 Madison Ave., New York 16, N. Y. $8.50.

Review of metallurgical literature; power, test, and research reactors; fuels and source materials; reactor safety; radiation and radio-isotope applications and facilities; marketing, sales, and investments in atomic energy; atomic activities outside the U.S.; and a review of Geneva Papers. (W11, T11)

X Instrumentation

Laboratory and Control Equipment

31-X. More Steel—Less Fuel, Part I. J. R. Green. *Instrumentation*, v. 10, Jan.-Feb. 1957, p. 13-16.

Problem of adding simplification and ruggedness to industrial instruments and control systems. (X general, 17-7)

32-X. Titanium Diaphragm Used for Telephone Receiver. K. Masuzawa and S. Magai. *Nippon Telegraph and Telephone Public Corporation, Electrical Communication Laboratory, Reports*, v. 3, Dec. 1955, p. 19-21. (CMA)

Titanium is better than duralumin as a material for a telephone receiver diaphragm. Such materials must have good tensile and creep strength, high Young's modulus and corrosion resistance, low density. Comparative test of performance and ease of manufacture described. (X15, 17-7; Ti)

33-X. The B.I.S.R.A. Suction Pyrometer for Open-Hearth Furnace Uptakes. R. Barber, D. Meachen and W. Bateman. *Iron and Steel Institute Journal*, v. 185, Mar. 1957, p. 343-347.

A suction pyrometer, with its shield system inside the water cooled probe, is shown to give reasonable accuracy and a much improved life in the temperature range 1000-1400° C. Indicates how the accuracy and life were determined, and gives recommendations and practical hints for the use of the instrument in determining the temperatures of preheated air, particularly in openhearth furnace uptakes. 6 ref. (X9, D2)

34-X. Removal of Inclusions for Analysis by an Ultrasonic "Jack Hammer". George L. Kehl, Hyman Steinmetz and Warren J. McGonnagle. *Metallurgia*, v. 55, Mar. 1957, p. 151-154.

Technique and apparatus for removal of inclusions in metals for identification purposes. Inclusions with minimum diameters of 10 microns may be removed by instrument employing pointed stylus oscillating at ultrasonic frequencies. (X4, 1-24; 9-18)

35-X. Vacuum Fusion Gas Analysis Apparatus for Use in the Quality Control of Ferrous Materials. K. Speight and G. M. Gill. *Metallurgia*, v. 55, Mar. 1957, p. 155-158.

Description of compact all-metal gas extraction system, and apparatus for analysis of the nitrogen, hydrogen and oxygen content of steel melt. (X21, 1-23; ST, *N, H, O*)

36-X. Ultrasonic Scanner and Recording System. W. N. Beck. *Nondestructive Testing*, v. 15, Jan.-Feb. 1957, p. 42-43; disc., p. 46.

Ultrasonic scanner developed at Argonne National Laboratory to handle production volume is described. (X8, 1-24)

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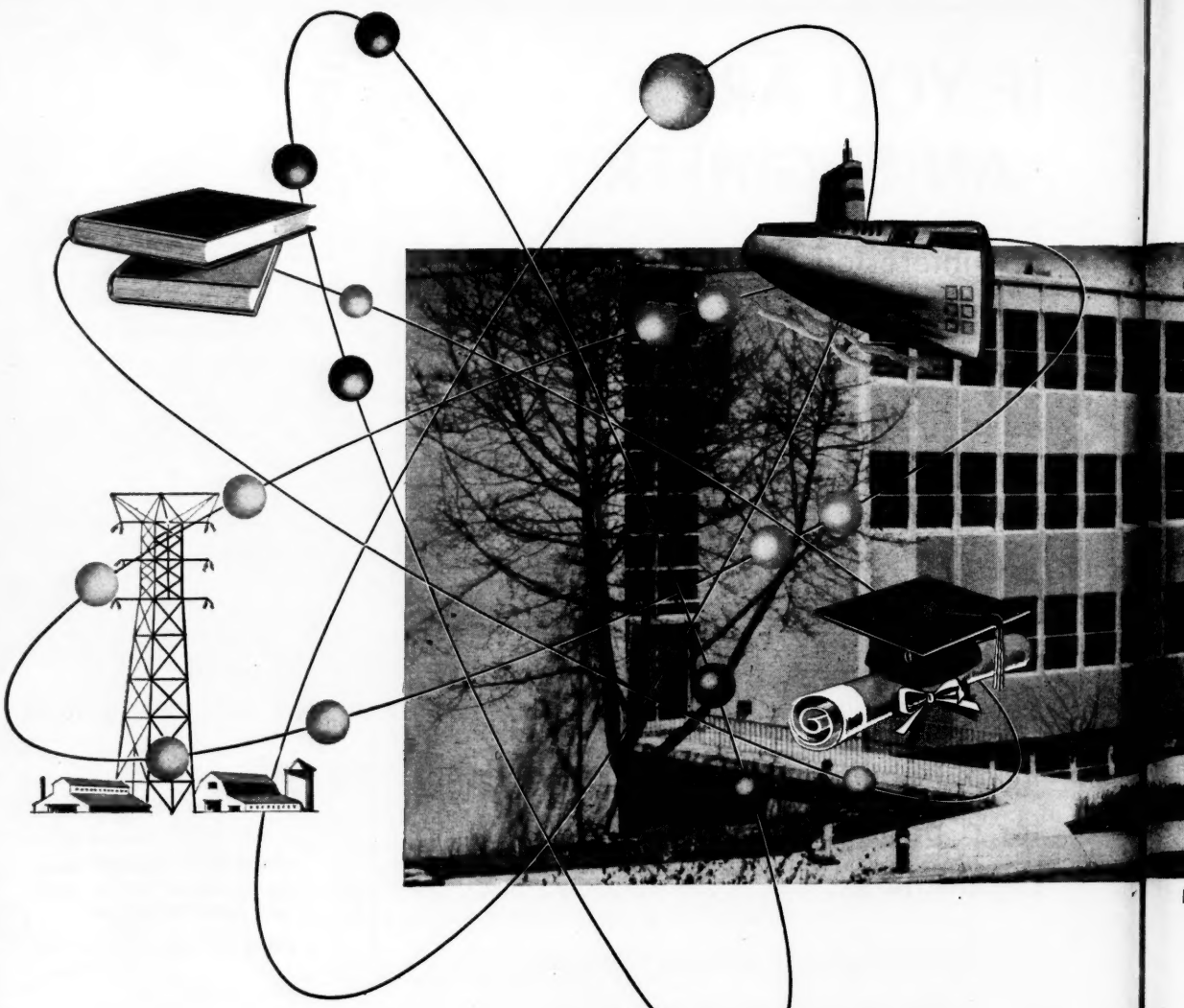

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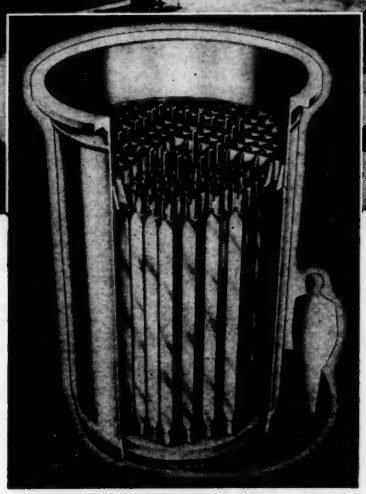

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A committee of judges will be appointed by the Metal Congress management which will award a First Prize (a medal and blue ribbon) to the best in each classification. Honorable Mentions will also be awarded (with appropriate medals) to other photographs which, in the opinion of the judges, closely approach the winner in excellence. A Grand Prize, in the form of an engrossed certificate and a money award of $100, will also be awarded the exhibitor whose work is judged best in the show, and his exhibit shall become the property of the American Society for Metals for preservation and display in the Society's national headquarters in Cleveland.

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